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An Illinois Joint Commission for the Settlement of Coal Mine Troubles.

We have received from Herman Justi, commissioner Illinois Coal Operators' Association, at Chicago, a statement of the organization, methods and underlying principles of that association and of the practical workings of a joint commission having members representing both mine operators and their employees, in settling disputes or differences that may arise and avoiding strikes or serious troubles of any kind. The statement which has been given to the press in response to many inquiries (probably stimulated by the present strike in the anthracite region) is too long to be printed in full here, but we may say that it shows that the coal operators of Illinois have had an experience strikingly similar to that of the stove manufacturers, which we have already related in our columns, *i. e.*, they were often subjected to unreasonable demands by the men and sometimes had all their work stopped to enforce demands that could not be granted, while on the other hand trouble was often precipitated by the harsh, unreasonable or unfair treatment given the men in a few mines by operators seeking an unfair advantage in the markets, and thus making it increasingly difficult to keep peace with the men in all the other mines. Finally the men became so well organized that they had things pretty much their own way—too much, however, for their own good—and this led to an organization of the operators of the State and finally to an agreement between the two organizations which is declared to work as well as any human arrangement can be reasonably expected to work. Under this arrangement agreements as to wages and general terms of work, etc., are made by joint conference on the first of April of each year for the ensuing twelve months, and a prominent feature of the agreement is that there shall be no strike nor lockout, but work shall go on in every case pending a settlement of any dispute or difference that may arise. Mr. Justi's statement goes on to say:

"It is confidently believed that such a commission, devoted exclusively to this particular work, and becoming with each successive experience more and more proficient, can and will settle differences and disputes between operators and miners more speedily, more satisfactorily and with greater fairness than is possible in the very nature of things by the busy employer engrossed in the ordinary cares of his business, for we well know that the average business man engaged in coal mining has enough on his hands without acting as his own representatitve in settling labor differences and disputes, as coal mining is a business in itself just as much so as the settlement of vexed labor questions is a business in itself; and since operators and miners are so directly and selfishly interested in the subject under dispute, they are poorly qualified to sit in judgment in their own case or to act as counsel in their own behalf. It has been truthfully said that there are elements in an industrial controversy which appeal too strongly to personal interests to allow the parties themselves to look upon the questions submitted broadly and philosophically.

"The commission, therefore, does not promise to always settle questions in dispute just precisely as the operator may seem to wish or expect, but it will use its best intelligence, supported by ever-increasing experience, to settle them fairly, and unless they are thus settled rancor grows and sooner or later there will be an outburst, the consequences of which will be much more costly than any advantage can amount to that has been obtained by cunning and stratagem on the one hand or brute force on the other.

"The commission insists that the way to avoid trouble is to make a right beginning and to have a clear understanding at the outset. It suggests as the first requisite that in entering into annual inter-state, state and district agreements or contracts with the Mine Workers' Union, all such agreements and contracts shall be made in writing (nothing left to conjecture or memory) and couched in language so plain that the simplest mind may grasp their full meaning, for there is nothing so true as the declaration that 'half the errors and controversies which fill the world with confusion would cease to exist if men spoke and wrote with clearness and accuracy.' Having made such a beginning and all the terms and conditions of every contract and agreement being clearly expressed, the commission of the Illinois Coal Operators' Association, jointly with the officials of the Mine Workers' Union, will seek to strictly enforce their letter and spirit upon the miner and operator alike.

. . . . . .

"It is now little more than four months since the commission entered upon its duties and has sought to enforce all the terms of the different joint agreements. During that period between fifty and sixty cases of real or alleged violations of the several agreements—varying in degree and kind—have been referred to it by operators who are members of the Association, and every one of these cases has been taken up and considered either in the commissioner's office in Chicago, at the office of the United Mine Workers in Springfield, Ill., or at the mines where the complaints originated, jointly with the officials of the United Mine Workers of America; and with three or four exceptions—and these are still under advisement—they have all been settled and that, too, I believe, to the satisfaction of both operators and miners.

"The plan pursued in settling all questions referred to us is very simple and is free from all formality. Thus far representatives of the United Mine Workers

and the commissioner of the Illinois Coal Operators' Association have met by agreement and with them such miners and operators as were directly interested. Together these representatives of the two interests would hear testimony with a view of eliciting all facts bearing upon the questions involved, and unlike the custom in legal proceedings, no attempt was made to gain any advantage by confusing witnesses but on the contrary they were encouraged to tell the truth, in order that disputes might be settled upon their merits solely. If necessary to a thorough understanding of the case under consideration, the miners' officials, commissioner and witnesses have gone down into the mine to see for themselves all conditions that could have any bearing upon it.

"The main idea of the joint commission it must be borne in mind, is to bring out clearly the exact facts, and, practically, when this is done, the case settles itself, for when all the points are made plain to the contending sides, the one in error usually admits it before any decision is rendered, and where this is the case the settlement is the more satisfactory for reasons that must be readily apparent.

"This plan has the further advantage of bringing employer and employee closer together and of establishing between them more friendly relations, at the same time that the representatives of operators and miners are afforded an opportunity of administering, without presumption or offense, some well meant and much needed advice or imparting valuable information designed to prevent future and more serious misunderstandings.

"It is due the cause of truth and also as supporting the plan of conciliation adopted by the Illinois Coal Operators' Association and the Miners' Union in that State to say that the commission has found the miners' officials prompt, courteous and fair in the consideration of every question brought before them, and the miners with whom we have come in contact have also, as a rule, yielded to our appeals where right and reason seemed to be on the employers' side. Employers, on the other hand, have accepted with proper grace and in a commendable spirit the adverse decision of their commissioner. All this goes to show that there is a common-sense business-like plan that should appeal to and commend itself at once to the quick intellect of the practical American business man—a plan that American employers of labor can at least afford to try without injury to any one should it here and there, or altogether, fail. But it will not fail, and the sooner all branches of industry in America are thoroughly organized and each branch or division establishes a labor commission similar to the one I have outlined for the settlement of all differences and disputes that may arise between master and man, the sooner shall we be rid of that obstruction to our commerce and that menace to our peace—the labor strike. Then all such differences and disputes can be fairly settled, because daily experience will make of such commissioners experts in their peculiar calling, who, besides the practical knowledge they may acquire in the ordinary course of their labors, will be possessed of what is always necessary in treating successfully with the laboring classes—a spirit of perfect fairness together with broad human sympathies."

Employees Holding Out the Olive Branch.

A novelty in the way of a labor organization has come into being among the machinery trades at Columbus, O. It is an employees' union formed, not for the purpose of enforcing the rights of its members by recourse to strikes and boycotts, but rather to deprecate and exclude such measures and to promote a policy of conciliation. It is known as the Machine Trades' and Professions' Association, and is composed of workmen in those trades directly connected with the construction and maintenance of machinery—pattern-makers, molders, blacksmiths and machinists—with provision for an honorary membership of manufacturers, superintendents, draftsmen, chemists and the like. The objects of the association are stated in its constitution to be social intercourse and instruction, etc. The question of manner of service and recompense for labor is considered one of "private individual privilege of adjustment," but where not so adjusted, arbitration through the officers of the association is provided for. The feature that will probably cause sharpest controversy among workmen is the provision that "no member shall take part in any strike or boycott, except in a proper manner to defend himself against such," nor shall he belong to any organization countenancing strikes or boycotts. This new union has already secured an agreement in joint committee, with the Metal Manufacturers' Association, of Columbus, by which the former party agrees to abstain from strikes and boycotts, and the latter to submit grievances to arbitration. They also jointly endorse the principle of national arbitration. The question whether to sanction the Machine Trades' and Professions' Association is expected to come before the National Founders' and National Metal Trades' Associations at their next conventions.

Insect Pacemakers.

"Behold how great a matter a little fire kindleth." The fire in this case is that of the familiar firefly of the summer night, and it provokes "The Electrical World and Engineer" into an interesting disquisition the drift of which is indicated in the opening sentences, which are as follows:

"Lives there the electrician who can watch a firefly without a trifling but persistent sense of annoyance? The little bug winks maliciously in the possession of his secret, until the electrician goes home and turns on the 5-per-cent efficiency incandescent lamp to kick himself by. Years ago a merchant in the town of our boyhood failed ignobly and paid his enraged creditors five cents on the dollar. They nursed their wrath in silence until the next Fourth of July, and then in the annual procession of Antiques and Horribles sent forth a platoon of tatterdemalion sandwich men bearing the legend, '*We Pay Five Cents on the Dollar.*'"

Perhaps not least of the functions of the insect world is setting the pace for humanity in the possibilities of accomplishment. It is not to be supposed that the efficiency of the firefly has been very accurately measured, but he seems to give so much light for so little fuel that it is not easy to keep within sight of him. We are not sure, though, that the firefly is any further ahead of the electrician than the mosquito is ahead of the dun. Many a bill collector must hang his head in humilition before the annoyances perpetrated upon and around him by those agile and ubiquitous pests. The power that carries the infinitesimal beast cannot be within comparable magnitude with the power expended in slapping the places where he generally is not.

The Board of Ordnance and Fortifications has recommended to the Secretary of War that no more disappearing gun carriages be made. The action of the board, if sustained, will make a great change in the prospective development of our coast defences. There has for some time been much contention concerning the utility of the disappearing mounts. The consensus of opinion seems to have been that while the disappearing carriage is good for low sites, it is not best for high sites, while the recent action of the board practically rejects them for either position.

Edwin C. Davis, who lately undertook to fit up a machine shop at Fort Edward, N. Y., called the Eureka Machine Works, has abandoned the enterprise, and is charged with bad faith toward his creditors, one of whom tells us that he bought machine tools and supplies on credit and sold some of them without removing them from the railroad, and it is expected that he will endeavor to sell elsewhere the remainder without legal or moral right to do so.

The trustees of the American School of Correspondence, 156 Tremont street, Boston, Mass., have decided to grant a limited number of free scholarships to men in various industrial establishments and various parts of the country. Full particulars regarding these scholarships can be obtained by application to the school named.

Personal.

H. C. Peters, recently general manager of the National Machine and Tool Company, of Boston, has accepted the position of superintendent of the American Arithmometer Company, of St. Louis.

William Forsyth, formerly general superintendent of motive power of the Northern Pacific, has been appointed mechanical engineer of the Pennsylvania Coal Company, with headquarters at Scranton, Pa.

Fred. A. Geier, secretary and treasurer of the Cincinnati Milling Machine Company, has been elected first vice-president of the Business Men's Club of that city. In the reorganized board he is chairman of the membership committee.

Commercial Review.

New York, Saturday Evening, Oct. 13.

THE DOMESTIC AND FOREIGN MACHINERY MARKET.

It is a foregone conclusion that there will be no material change in the state of business until after the 6th of next month. Machine tool sales offices are not all agreed that there is no picking up in trade, but the reports of flatness are unquestionably the characteristic ones. As the election approaches, the tendency to defer to that event is more apparent. An enterprise amounting to $1,000,000 is said to be pending, contingent upon the outcome. The nature of this project is not stated, but there is a definite one amounting to $400,000, of which the same fact is asserted.

The latter is the project of the American Car and Foundry Company, of St. Louis, to erect at Detroit, Mich., a plant for the manufacture of steel cars, as mentioned in the last issue of this paper. The scheme has taken such shape that Westinghouse, Church, Kerr & Co., have been appointed engineers for the work. The Pressed Steel Car Company is now enjoying such abundant business that it is no wonder that competition grows in pressed steel freight cars. It will probably become pretty lively until it gets to be overdone. The plans for the plant at Detroit are to be drawn up at once, but no further contracts for erection of the work are to be given out until after election.

A 1,500 kilowatt Parsons turbine has been ordered from the Westinghouse companies by the Hartford (Conn.) Electric Light Co. The same manufacturers have contracts for four drawbridge motor equipments for the Delaware, Lackawanna & Western Railroad. These equipments are of about 50 horse-power and cost about $3,000 each.

Among the manufacturers who have expressed themselves upon the question whether it paid to exhibit at Paris, the E. W. Bliss Company comes out with a strong affirmative. That concern was awarded a Grand Prize for its exhibit of presses, dies, shears, drop-hammers, and other tools for working sheet metals, and attributes to this exhibit a large number of orders which it has booked. These orders are the more gratifying, as they have been taken in competition with all the principal press builders of the world. The company's new plant is about completed. It will be fitted out in the most up-to-date manner. A large electric light and power plant is to be installed. Each floor will have a separate motor for driving the main shafts, while all of the larger machines will be driven by independent motors. Work on the new foundry, 200x130 feet, is also well under way.

Mr. Julius Fischer, managing director of the Deutsche Garvin Maschinenfabrik Aktien Gesellschaft is now visiting the United States. At the office of the Garvin Machine Company, in this city, he conversed with a representative of the "American Machinist" upon European business conditions. A few years ago, said he, there was a demand for tools in Germany far in excess of the domestic abilities to supply, and this was stimulated especially by the bicycle industry. But now that the urgent call from this source has ceased and since the home output of tools has greatly multiplied—in fact, about doubled—American builders have the odds against them. A year ago German shop-owners were so controlled by the necessity to buy American tools that the high prices demanded did not stand in the way, but this season the prices are a great obstacle since buyers can obtain plenty of regular tools of American types from German manufacturers at low prices. For instance Mr. Fischer says an American lathe costing 3,100 marks has against it one of the same size and for the same work, made in Germany to sell at 1,300 marks (an inferior tool). He is not willing to admit that in quality the imitations always fall short of their American prototypes. Some of the German built tools, he maintains, compare favorably with the most celebrated American makes. Tool manufacturers in the United States, he remarks, are not all on a par. While some build first-class machines, there are others who build second, third and fourth class. The same criticism is made of their methods of doing business. The fact that they did not all conform to the highest standard of fairness and were not all free from the tricks of trade he believes to be one reason why the demand for American tools has not been better sustained. American manufacturers should visit Germany more frequently and study the local methods—not the technical so much as the commercial ones. The German laws requiring the enforcement of contracts are very strict, and if an order is once taken, it must be executed or the manufacturer must pay for the loss incurred by getting it filled elsewhere. It is displeasing to the German buyer when the party with whom he is dealing takes a light view of contractual responsibility.

In saying that the reputation of American tools, which formerly was very high, has been greatly injured by inferior machines that have been put upon the market, Mr. Fischer is emphatic that it is not the standard builders who are at fault, but those of inferior grade who have no good tools to offer.

German shops will ever be willing to consider American special machines, Mr. Fischer states, and whenever our manufacturers get up anything new, they will do well to let it be known in Teutonic marts.

One remark of Mr. Fischer's suggests a matter which has not hitherto been touched upon so far as we are aware—the question whether with a lessening call for American tools abroad our manufacturers can hold the zealous co-operation of native importing firms which hitherto has been of such inestimable assistance. A certain house is mentioned which heretofore has been a dealer in American tools almost exclusively, but which now is turning an increased amount of attention to the home-built machines so readily obtainable. The Garvin selling interests, however, do not propose to neglect the American manufacturers whose agencies they hold. These agencies are to be retained even after the manufacture of Garvin machines is commenced in Berlin. It may be inferred, therefore, that the company expects to find a continuing sale for American machines of high grade.

The new German Garvin works are not yet in operation, but are expected to start up about the end of November. In addition to the German market for their product they are looking towards Russia, France, Austria, Sweden, Italy, etc.

Mr. Fischer does not regard the opening up of China, in which his sovereign is so much interested, as a serious factor in the machine tool trade for a long while to come, since the need of tools there will wait upon the industrial development of the country.

Over the Spanish market, Mr. Fischer is not enthusiastic. He says that it is almost impossible to sell any but the cheapest and simplest tools. This bars out American machines, which have to face the competition of the numerous low-priced German manufacturers who have sprung up in Chemnitz and elsewhere. This preference for cheap tools is one for which the Russian market also was formerly noted.

But Mr. Fischer's view of the outlook is not entirely unfavorable. He admits that there is still a good demand for special machinery. Moreover, he takes no great stock in the opinion that Europe is settling down to a long period of general business depression. Money in Germany is dear at present, but the face of affairs may change very quickly, he says.

It may be remembered that two weeks ago we quoted, with some question, an opinion of an authority upon European

trade, that a universal depression is setting in. Although this is by no means a foregone conclusion, the indications which point that way are not frivolous. While the article referred to was in press that conservative daily, "The New York Journal of Commerce," came out with a leader in very nearly the same strain. After alluding to the European financial stringency and to political events as a minor cause thereof, it said: "The essential difficulty is the absorption of available capital in more or less speculative enterprises. The revival of industry in 1897 brought the usual phase of a large production of finished goods, which in itself is beginning to threaten a glut unless the mill wheels are stopped. In the meantime the appearance of Russia in the loan market, drawing several hundreds of millions from the savings of Western Europe for the extension of her railway system, and the scores of industrial enterprises in Russia and the Orient, whose securities were issued at Paris, Berlin and Brussels, made a heavy draft upon the surplus capital of the world. The extension of electric enterprises in France, Germany and other countries has also called for large sums, with the result that the banks are nearly at the end of the resources with which they have financed the new enterprises. With the relaxation of the demand for finished goods and the closer scrutiny of new stock company projects which are now taking place, bubbles are being punctured and weak and dishonest enterprises are beginning to fall to the ground. . . . It would not be surprising if another economic crisis, followed by the long period of depression which has been so marked a feature of events of this character in recent years, were within the horizon of the next few years. . . . While there is perhaps no immediate ground for apprehension, far-sighted bankers and men of business will keep their eyes fastened upon the development of events and include in their horizon the trend of trade and money rates abroad as well as at home."

CHICAGO MACHINERY MARKET.

The electrical machinery trade is concerning itself more closely with small orders than with large ones, not from choice but because of a scarcity of the latter class. There are inquiries enough to satisfy everybody, in fact inquiries are quite abundant, but when the specifications sent out to the electrical men are figured upon and estimates are made and submitted, the answer of the proposed buyer is that he will let the bidder know about it "in several weeks" or "later." From the number of these estimates, that have been made and are now pigeon-holed temporarily, the expectations of the trade run high for a brisk winter's business in the ordinary course of events. The inquiry is as broad as the application of electrical power.

A prominent consulting electrical engineer remarks that just now prospectors are investigating the water power resources of the State of Illinois and other parts of the West, as with a fine tooth-comb. There is little water power of any great magnitude in this region, except that of the drainage canal at Lockport, but throughout the State there are many localities where a moderate power can be developed and these possibilities are under examination. One reason for the activity in that line is that the power thus generated can now be economically transmitted from fifteen to twenty miles, which fact makes many sites of water power valuable, which would be worthless were the power to be used on the spot. There seems no doubt that the forces of the drainage canal will be utilized soon, probably by the city of Chicago; the ordinance to that effect is now awaiting the signature of the mayor.

The electrical machinery inquiry is large for the development of street railway projects, municipal lighting plants, and for factory and shop use. The Laclede Power Company, of St. Louis, is erecting a new plant on the banks of the Mississippi in that city, having decided to embark in the lighting as well as power branch of electrical production. It has purchased, it is said, three 500 kilowatt generators for this new structure. The Acme Harvester Company, which has a large manufactory in course of construction at Peoria, Ill., has purchased from the Northern Electrical Machinery Company a complete electrical equipment of 1,500 horse-power. Among the various cities that are calling for estimates, Indianapolis seems to be well to the fore.

The Sprague Electric Company has sold three 75 kilowatt generators to the Ohio State Hospital for the Insane at Toledo. Kohler Brothers have sold the electrical equipment for the new Lord Owen & Co. building on Randolph street, Chicago. Specifications are out for a number of motors for the Ritchie Box Works, of this city.

CINCINNATI REPORT.

Conditions in the local manufacturing districts are of a somewhat complex character. While in some sections among machine-tool making concerns there has been a phenomenal impetus in orders for new work, in others there has been no perceptible increase in this way, and yet a good sized force is kept busy on old orders. Probably the most flattering conditions are shown among the boiler makers. The Tudor Boiler Works people are as busy as bees, and announce that they have fully six months' work ahead on water-tube and high-pressure goods. This company will have for delivery in Chicago, next month, six large boilers, all for use in connection with power machinery. They have just completed several big salt evaporators, special apparatus to be shipped to Durango, Mexico. This order will amount to about $6,000. Three big high-pressure boilers are in process of manufacture for the Fleischmann interests here; one for the Emery Candle Company, and they are just finishing the establishment of a plant for the Enger Carriage Company, a new branch of the larger concern here. This order is for a 300 horse-power water-tube boiler. Mr. Charles Tudor, of the firm, says propositions are out for work aggregating over 50,000 horse-power capacity, and that the tendency of people to hold off until after election is, in this instance, quite satisfactory to his concern, inasmuch as it gives them an opportunity to handle the phenomenal business for immediate delivery. Early in the new year the Tudor people will put in a new riveting plant.

The Cincinnati Milling Machine Company continues to run on a 58-hour schedule in practically all departments, and orders are increasing. A number of good-sized contracts were lately closed in New York and the New England States.

Mr. Murray Shipley, of the Lodge & Shipley Machine Tool Company, who has been in the East on an inspection tour for the last ten days, is not expected home for a week. Mr. Shipley is a close observer of conditions, and his report will be awaited with considerable interest. The belief is general that while the nearness of election has been instrumental in holding off many orders, normal conditions will be resumed, perhaps before that event; certainly, very soon after. Prices are expected to maintain, and perhaps increase a little.

Quotations.

NEW YORK, Monday, Oct. 15, 1900.

Iron—American Pig, tidewater delivery:—

Pennsylvania Irons:

No. 1 X foundry	$16 25 @ $17 75
No. 2 X foundry	15 50 @ 16 50
No. 2 plain	14 75 @ 15 75

Alabama Irons:

No. 1 foundry, or soft	15 75 @ 16 25
No. 2 foundry, or soft	14 75 @ 15 25
No. 3 foundry	14 25 @ 14 75
Foundry forge	13 00 @ 13 50

Bar Iron—Base sizes—For good refined brands on dock, 1.40 @ 1.55c., and for same from store 1.70 @ 1.75c., though as low as 1.65c. is also quoted.

Tool Steel—Base sizes—Good standard quality, 7 @ 8c.; extra grades, 10 @ 14c.; special grades, 16c. and upward.

Machinery Steel — Base sizes — From store, 1.60 @ 1.80c.

Cold Rolled Steel Shafting—Base sizes—From store, 2¼ @ 2½c., according to quantity.

Copper—Lake Superior, ingot, in carloads, 16⅞c.; electrolytic, 16⅝ @ 16¾c.; casting, 16½ @ 16⅝c.

Pig Tin—28½c. for 5 and 10-ton lots, f. o. b.

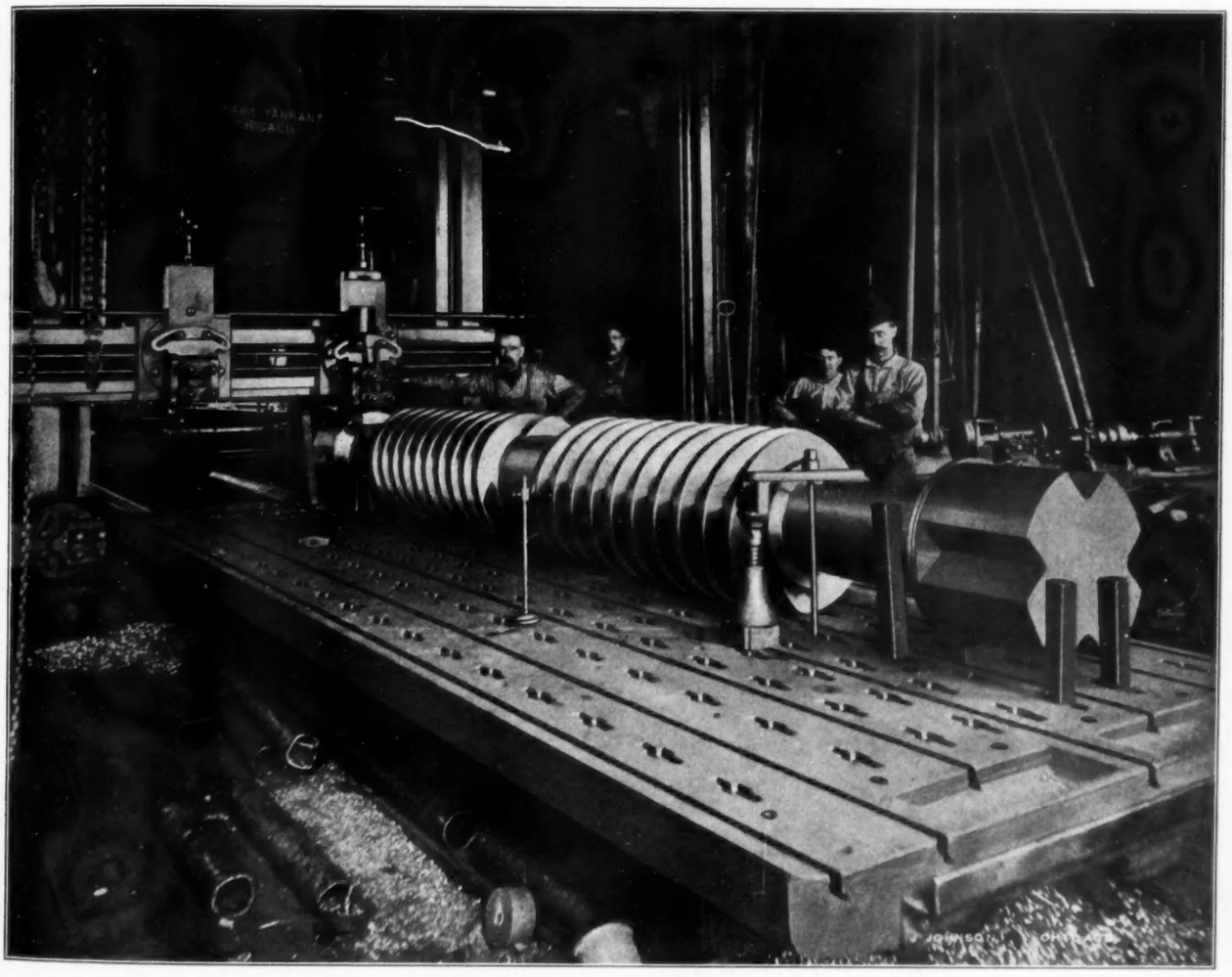
Lead—For wholesale lots, 4⅜c., with .02½ @ .05c. extra for carloads.

Spelter—Prime Western, 4.20c., New York delivery.

Lard Oil—Prime city, in 1 to 5-barrel lots, 61c.

A Big Right and Left Steel Screw.

The half-tone in this case speaks for itself. The screw shown receiving its finishing touches on the planer is to be used for setting up the edging rolls of a plate mill in the South Works of the Illinois Steel Company. The screw is 23½ inches in diameter, 11-inch pitch, double threaded, and its length over all is 17 feet 6 inches. It was made from a solid steel shaft, cast by the Illinois Steel Company, which weighed, in the rough, 24,100 pounds, the weight of the finished screw being 14,000 pounds. The screw was in the lathe about ninety days. The lathe used, built in the shop, is 57 inches by 26 feet. It has a gear on the face-plate from which the lead screw was driven by a pinion to produce the coarse pitch required. The entire work was done in the shop of Robert Tarrant, 52 to 56 Illinois street, Chicago. It will be noticed in the half-tone that the planer also was built in the shop.



A BIG RIGHT AND LEFT-HAND SCREW.

"Henry has insomnia, but he got a good sleep last night." "Opiate?" "No; I read him the list of prizes awarded at the Paris Exposition."—"Chicago Record."

An Automatic Brush-Back Boring Machine.

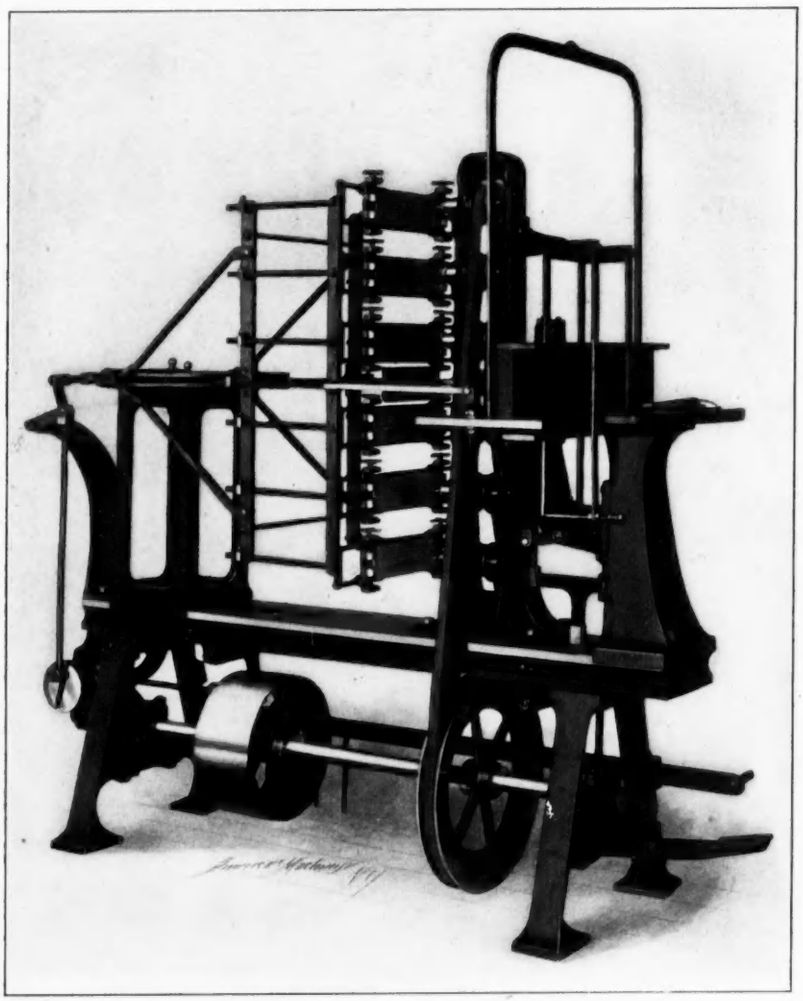
The interesting machine shown in the half-tone has been designed for boring the wooden backs of brushes for the insertion of the bristles. It must be evident to anyone that the boring of a brush-back is not the simplest operation in the world, as each hole stands at a different angle from its neighbor, and in drilling the holes successively there must, for each hole, be a change in the inclination of the drill, or of the stock in relation to the drill. In this machine the positions of the boring bits are fixed and the required inclination is given to the brush-back by the movements provided on the machine. Six backs are bored simultaneously, one hole in each at a time, the six bits being driven by six belts riding one over the other on the flanged driving pulley on the countershaft below. In describing the machine, we therefore have nothing more to do with the boring bits, it being provided that the point of each projects the same as the rest, so that with equal movements of the brush-backs the holes will all be bored to the same depth.

The six brush-backs being bored are shown in position in the machine, adjusted and secured by thumb screws, which requires no remark. The entire frame which carries the work is automatically moved towards the bits and back again at the rate of 60 per minute, so that 360 holes are drilled per minute. This feed movement of the carrier frame is taken from the worm-driven crank shaft below, by the connection and bell-crank lever shown. The crank, as will be seen, is adjustable for different throws as may be required.

To give longitudinal movement to the brush-backs, so that the different holes may be drilled, the carrier frame swings upon a pivot indicated by the nearest of the two round-head pins seen on the top of the flat table at the back end of the machine. Supposing the central hole of the brush-back to be bored perpendicular to the back, it will be seen that those toward the ends will be drilled at angles increasing with the distance from the center. If the center upon which the frame moved was fixed it is evident that the holes near the ends of the back would be bored deeper than those nearer the center, and to correct this the end of the farther of the two round-head pins projects down

into a V-shaped slot in the moving part of the frame, the slot operating to draw the frame backward a little as it swings laterally, and thus to correct the movement. A flat plate is seen in the middle of the front of the swinging frame parallel with the brush-backs. An adjustable horizontal pin projects from the front of the boring bit frame in the same direction as the bits, and when the holes are bored to the required depth this pin comes in contact with the plate and serves as a stop in case the bits or twist drills should have a tendency to pull in to the work.

The brush-backs, besides the horizontal movement, require also a vertical movement, to reach all the holes in the other direction. For this movement the radius is shorter, so that for any given distance moved the difference of angle is greater than for the longitudinal movement. Two uprights are seen at the side of the swinging frame, with two corresponding uprights on the other side of the machine.



AN AUTOMATIC BRUSH-BACK BORING MACHINE.

The brush-back holders swing in the nearer uprights, with rods extending backwards and pivoted on the farther upright. The radius for the vertical movement, therefore, is the distance from the nearer to the farther upright, while the radius for the horizontal movement is from the plane of the nearer uprights to the round headed pin in the table.

The required movements of the brush-backs being provided for it only remains to see how these are directed and controlled. A rod extends horizontally on each side of the machine from the middle of the swinging frame to the template carrier. This template carrier is a rectangular box or frame, having both horizontal and vertical movement between the light vertical guides at the near end of the machine which apply sufficient friction to hold the carrier in any position in which it may be left, the weight of everything connected being counterbalanced by a cord not shown running over a sheave at the top of the light frame extending above the machine. The template consists of a rectangular block of wood with a number of round, spring-actuated, sliding pins corresponding to the holes to be bored in the brush-backs. The distance between the pins is greater than the distances of the holes in the brush-backs, on account of the greater radius of movement. The pins all stand perpendicular to the block, they being horizontal while the block is vertical, and the pins are all held by the springs normally outward, so that they project but slightly and uniformly beyond the inner face of the template. Close to this inner face of the template are two vertically sliding, right-angled V's, operated by suitable levers and connections from a cam on the other end of the crank shaft. One of these V's works upward and the other downward and both back again at each feed movement of the machine. When at the extreme of their movement in one direction the V's form a square opening of about 3 inches, while at the other extreme the square is only ¼ or 3-16 inch, equal to the diameter of one of the template pins. If when the square is open one of the pins is pushed in, the square will close upon it and bring it to the central position, moving, of course, at the same time the template holder and the series of brush-backs with which it is connected, bringing them all right for drilling the hole corresponding to the pin then projecting. The work of the operator consists in pushing in the template pins, one after the other, until all the holes in the backs are drilled, when they are replaced by others. For pushing in the pins the wooden handle seen lying on the machine is used. There is a hole in the handle of sufficient depth to secure the correct projection of the pin when the handle touches the template block. The treadle at the end of the machine throws the feed motion in or out, and the horizontal bar is the belt shipper. One of these machines is now on exhibition in operation at 110 John street, New York. The inventor, who is with it, is Mr. J. P. Ditchfield, of Manchester, England.

Tools for Interchangeable Work—VI

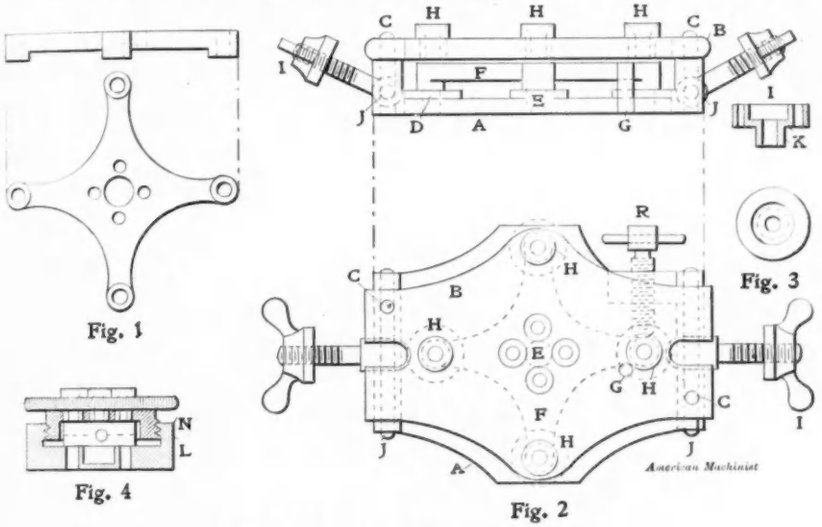
BY JOSEPH V. WOODWORTH.

JIGS FOR BEARING BRACKET AND BEARING.

Fig. 1 shows a casting of aluminum, used as the upper bearing bracket of the cloth cutter. After the hole in the center had been bored and reamed to fit the bearing, Fig. 3, at *K*, it was faced off on the front and back and was then ready for the jig, Fig. 2. As will be seen, there are four wings with a boss at each end, and a hole in the center of each. The holes were to be all interchangeable with those in the motor case described in No. 5; the four holes around the center were also interchangeable with those in the bearing, Fig. 3. All these holes were drilled in the jig, Fig. 2. This was made in two parts, the base *A* and the lid *B*. For these patterns and castings were made. There were four bosses in the bottom for the work to rest on while drilling. After the base *A* had been faced off on the back it was strapped in the miller and a cut was taken over the bosses and also over the end on which the lid rested. A hole was then drilled in the center of the base into which a plug *E* of tool steel, turned to fit the *center hole* in the work Fig. 1, was driven. The

work was then placed on it and the stop-pin *G* let in. The set-screw *R* having been made, a hole was drilled and tapped and the screw let in.

The lid *B* of cast iron after being planed on both sides was strapped to the top of *A* and holes were drilled for the two dowel pins *C C*, which were then let through into *A*, and the holes in *B* eased up so that the lid would set in nicely. *A* and *B* were then clamped together and a



JIGS FOR BEARING BRACKET AND BEARING.

slot was milled through each end for the locking posts *I I*. The posts were made and finished and hinged in *A* by the pins *J J*. Thumb nuts were got out and tapped to screw on to the posts freely. The posts were then swung over and the thumb-nuts tightened, thereby clamping the lid and base together. The jig was then stood up on the side *D*, which had been squared with the back, and the center of the stud *E* was found on the lid *B* with a hight gage, the holes for the bushings were laid out, centered, drilled and reamed, and the bushing made, hardened, ground and driven in. The jig was then complete; the lid was removed and the work, Fig. 1 was inserted, centering itself on the stud *E*. The set-screw *R* was tightened until the work was forced up against the stop-pin *G*, the lid *B* was replaced, the dowel pins *C C* locating it, the lock posts were swung up, the nuts tightened and all the holes drilled, which completed the operation. As will be seen, there is just enough space between the bottom of the lid and the work for clearance which was all that was necessary. The center holes in the castings being reamed to the size, and as nearly as possible in the center, thereby fitting the stud *E*, and the casting being of a uniform size they were easy to handle. The stop-pin *G* and the screw *R* were sufficient for all requirements of location. Clearance holes were drilled in the bosses on which the work rested, to allow an easy escape for the drillings.

Fig. 4 shows the jig used for drilling the four holes in the bearing, Fig. 3. As stated before, they had to match those in the bracket, Fig. 1. The bearing itself was of tool steel, turned and finished all over to fit the center hole in Fig. 1, and the center hole in the brush-holder bracket, described in No. 5. The jig used for drilling was of the box type, made in two sections. *L* was the base or jig proper, of round machine steel, a piece of which was chucked and turned on the outside and a hole bored and reamed to just fit the work at *K*. It was secured and a thread cut of a coarse pitch, leaving only two threads. It was then faced off and under-cut at the bottom, to allow the work *O* to set in as shown. The lid *P* was turned and threaded to fit the piece *L* nicely; it was also counterbored to go over the work and clamp the face when screwed down solid; the outside edge was heavily knurled to give a good grip. The work, Fig. 3, was inserted into one of the finished pieces, Fig. 1, and the four holes were transferred through it when it was removed and inserted in the jig *L* and used as a template, and the holes were drilled through it and through the bottom of the jig *L*. The top *P* was then screwed on and the holes transferred through *L* to it, when they were enlarged for the bushings which were made and driven in. This finished the jig. The work being inserted, the cap was screwed down and the holes (which were clearance holes for 6-32 screws) were drilled.

In the series of articles closing with this number it has been my aim to avoid all unnecessary description of minor details, the methods of making the tools, etc.; but I find that to understand thoroughly the main parts, the little points are as necessary as the greater ones. I wish to call attention to the fact that the tools were made in a manufacturing tool shop at a contract price, and it was found necessary to combine accurate workmanship and reliable tools, with simplicity in design, and as far as possible with cheapness.

A Novelty in Lathe Design.

The accompanying half-tone, Fig. 1, is from a photograph of a lathe embodying an unusual number of novel and interesting features, which are shown in detail in the reproduced drawings. The lathe was designed and built by C. Scholz, Charlottenberg, near Berlin, Germany. It is styled by him a "universal" lathe, and, as will be seen, it has a wide range of adaptability. If it may be thought that the designer had set out to produce a lathe as different as possible from those in common use, and that he has achieved considerable success

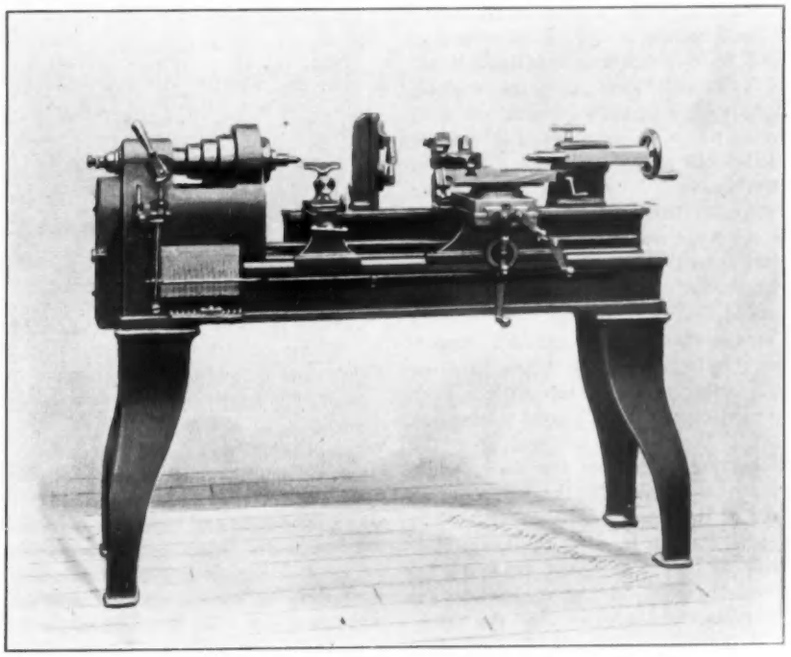


FIG. 1. A NOVEL UNIVERSAL LATHE.

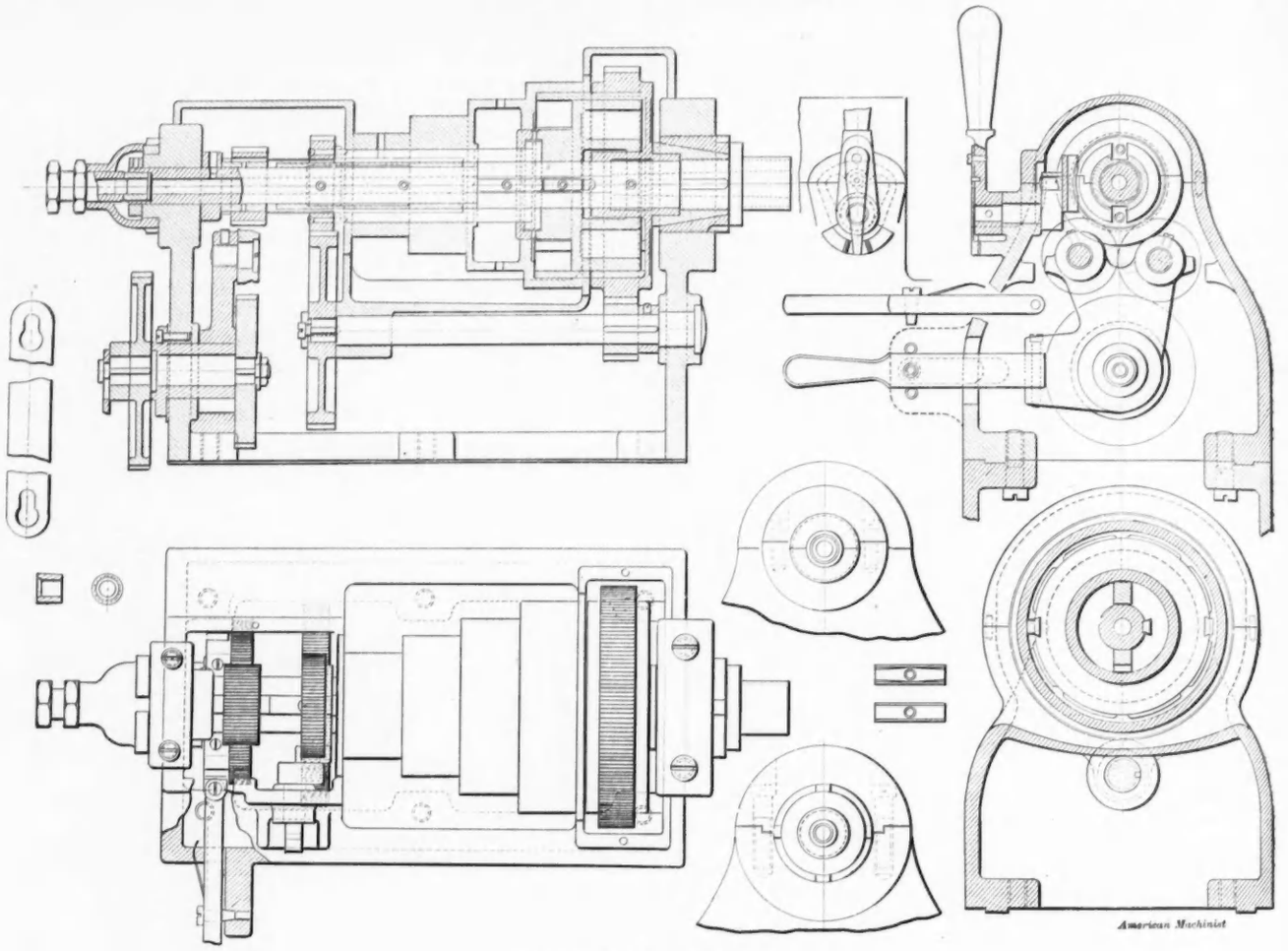


FIG. 2. THE HEADSTOCK.

in that direction, it may still appear later that the differences introduced are not without functional reasons for their employment. We can mention only a portion of the multitudinous details.

A section of the lathe bed, looking toward the headstock, is seen at the lower right-hand corner of Fig. 4. The end of the bed upon which the headstock is secured is flat and raised above the working portion, with a shallow groove on each side into which fit corresponding tongues on the bottom of the headstock. The bed has one heavy "V" in front and another at the back. Inside the "V" at the back there is a wide flat surface with a beveled lip, and upon this surface there is fitted a longitudinally adjustable beam with a dovetailed bearing and a gib for securing it. This beam might be called a supplementary lathe bed. The beam has two sliding surfaces on the top with a deep groove between them. The rest slides upon the front "V" of the bed and upon the front bearing surface of the beam, while the footstock travels on the rear bearing surface of the beam and the rear "V" of the bed. By sliding back the beam it is possible to obtain sufficient space to accommodate work having a diameter at one portion much greater than the diameter of the part to be turned, this space not being limited longitudinally as with a fixed gap. The arrangement of the slides also permits the carriage to be moved past the footstock. When using the hand rest, or when filing or grinding, the carriage may thus be moved entirely out of the way; also in turning very short work, it is thus not necessary to run out the tail spindle to an abnormal length; it may be set as short and may be as rigid as when used for the longest work.

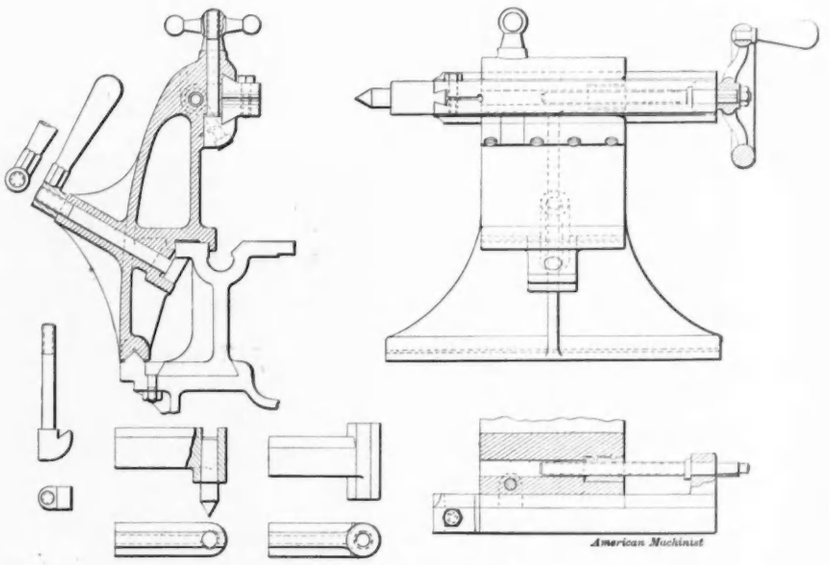


FIG. 3. THE FOOTSTOCK.

The headstock is a completely enclosed casing. The back gears are placed on bearings inside the headstock casing under the spindle. The bearing of the spindle is conical, as seen in Fig. 2. Fastened on the spindle in front is a bronze taper bear-

ing, which runs in a hardened-steel cone with an exterior thread, by means of which it can be adjusted in a divided bearing of headstock and fastened by screwing up the cover screw. The usual ring nuts are not on this lathe. A slight tightening of the steel taper bearing is sufficient to remove any play in running; the wear of the steel taper bearing in relation to that of the bronze being very slight, the alinement of the spindle is maintained, as well as by the fact that the box, by being turned to take up wear, has its own wear distributed instead of concentrated in one place. The rear bearing is rendered central by means of a bored pivot, which can be tightened, and which is supported in front by a cylindrical bearing. The larger end of the front taper bearing is, contrary to previous practice, directed towards the rear, so that when roughing work, and when springing in consequence of the same is unavoidable, excessive pressure on the taper bearing is avoided. An adjustable stop-screw is fastened on the rear of the spindle in front of the bearing. In front of this screw is a gear for driving the right and left-hand movement, and in front of this gear is a brass box with the cone pulley loose on the shaft. The driving gear for the right and left movement can be alternately coupled by two sliding wedges to the adjustable stop ring, and by this to the spindle, or it can be coupled to the brass box and from thence to the cone pulley. This alternative coupling is necessary in order to cut coarse-pitch threads.

The large gear of the back gearing, which also runs loose on the spindle, is situated in front of the cone pulley and behind the taper bearing. Between the cone pulley and gear, in the interior and completely covered, is a small disk, which is connected with the spindle by a spring, on which it can, however, be moved longitudinally. This disk carries two clutch rings on its periphery, and these clutch rings can be made to follow the rotation of the disk by means of a spring; but the small disk can also be moved longitudinally on the spindle without its taking the clutch rings with it. One of these clutch rings is in the cone pulley and the other in the gear, both being separate. On this disk, opposite the spring, a double tapered key is fastened, which, on being pushed along the disk, forces the one or the other of the clutch rings apart and presses them against the cone pulley or the gear, according to the direction in which it is moved. By this means the disk becomes coupled with one of these parts and thus takes up and transmits the motion of either the cone pulley or the gear to the spindle. The transmission from the cone pulley to the front gear is at a ratio of 1 : 8. The movement of the disk is effected by two keys, the heads of which gear into a fluted ring on the disk. These keys go through the cone pulley and are fastened to the driving gear of the back gear. This gear can be moved longitudinally on the brass box, but it is forced by a spring to follow the rotative motion of the brass box, and by this means it also takes the rotary movement of the cone pulley. The teeth of the driving gear are geared into by a clutch, which can also be moved by a hand lever from the outside. If this lever is moved to the left, the driving gear and disk (the latter by means of the keys) are also drawn to the left, by which means the disk, or rather the spindle, will be coupled direct to the cone pulley; at the same time, however, the driving gear is thrown out of gear with the second wheel (gear) of the back gear by the lateral movement, and the back gear is thus again brought to a standstill. If the lever is moved to the right, the cone pulley becomes uncoupled, the driving gear again gears into the gear of the back gear-

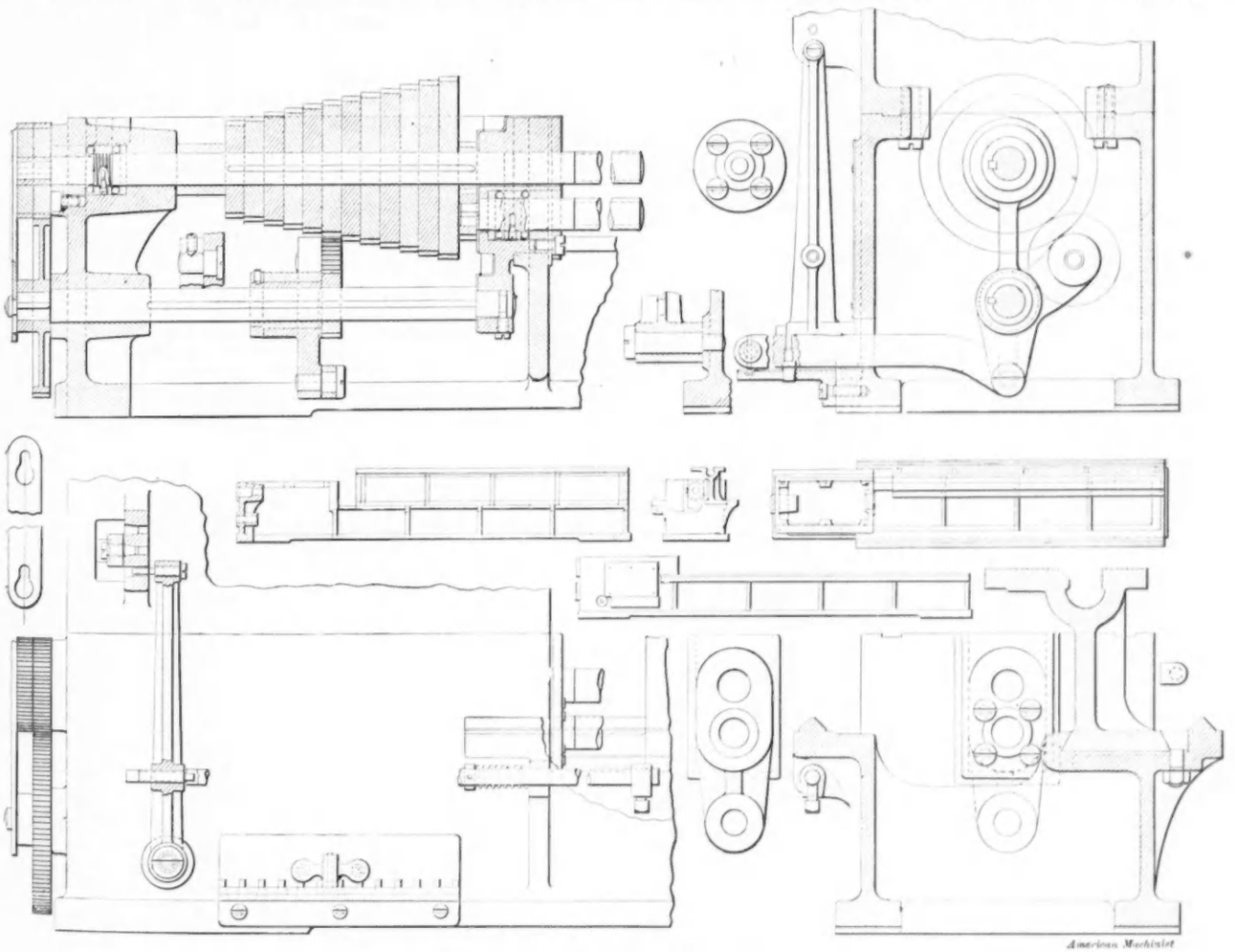


FIG. 4. CHANGE GEAR ARRANGEMENT.

ing, and finally effects the coupling of the disk to the front gear, by which the spindle receives the motion of this gear.

The lathe has two lead or feed screws which lie on bearings in the middle of the bed. One of these lead screws has four threads per inch and is used exclusively for thread cutting, while the other has eight threads per inch and can be used either for turning or for thread cutting, and in addition to this it transmits the movement to the cross-feed screw. Referring now to Fig. 4, the lower of these two lead-screws lies in ball bearings in the partition plate of the bed under the front plate of headstock, and the upper lead-screw goes under the headstock to the rear part of the bed and is supported there in ball bearings and then it projects out from behind the bed and has a pin to receive a bushing for the change gears. Fastened on this lead screw under the headstock there are twelve change gears for twelve different speeds. A short shaft lies somewhat lower in the bed, and this shaft also projects out behind, having a pin on which to receive the change gears. This shaft also carries inside the bed a movable device for changing the gears, the same in principle as the Hendey-Norton arrangement. In order to cut the 132 different threads shown on the index, it is merely necessary to have, with the arrangement above described, four change gears, besides the twelve gears on the lead screw, the four change gears consisting of two pairs at a ratio of 1 to 4.

The carriage, Figs. 5 and 6, comprises the main or horizontal part and the vertical part or apron, the latter, however, does not hang down over the front support of the carriage, its base traveling on the front "V" of the bed, while the rear end of the horizontal part of the carriage moves on the flat inner surface of the long beam. This is shown in section at the upper left-hand corner of Fig. 6. There is the usual cross-slide on the carriage with a revoluble compound rest above. The tool-holders have a round shank, so that the tools may be adjusted in any direction or position. The clamping device for the tool-holders is bored to the line of centers of the lathe, so that boring bars and other tools may be inserted. The power cross-feed screw lies in bearings in the front of the carriage in a movable piece of bronze which is hollow in the middle and encloses the gears which drive the cross-feed. This bronze bearing is connected with an eccentric and bevel gears by which minute movements of the slide are secured. The power cross-feed screw is driven by a worm gear which meshes into the upper lead screw. This worm gear drives another worm gear of the same size with a pinion on the side of it. The pinion drives an intermediate shaft which reaches into the bronze piece and from thence drives the cross-feed screw. This drive may be engaged or disengaged either by hand or automatically.

The nut for both lead screws is made in one piece, combining a half-nut for each, the upper eight to the inch and the lower four to the inch. This nut is shifted by an eccentric alternatively to engage with either screw. The eccentric shaft projects out of the apron and is operated by a double crank. On this shaft there is also the larger of the bevel gears which operate the eccentric for the power cross-feed. This bevel wheel also is provided with a crank which can be connected with the double crank. For ordinary turning and cross-feed work the bevel gears are idle. For screw cutting the tool can be withdrawn from the work by means of the crank on the bevel wheel without opening the nut, or this crank is connected with the double crank of the eccentric, the nut is disengaged at the same time by turning the crank, and the tool is then drawn out of the work.

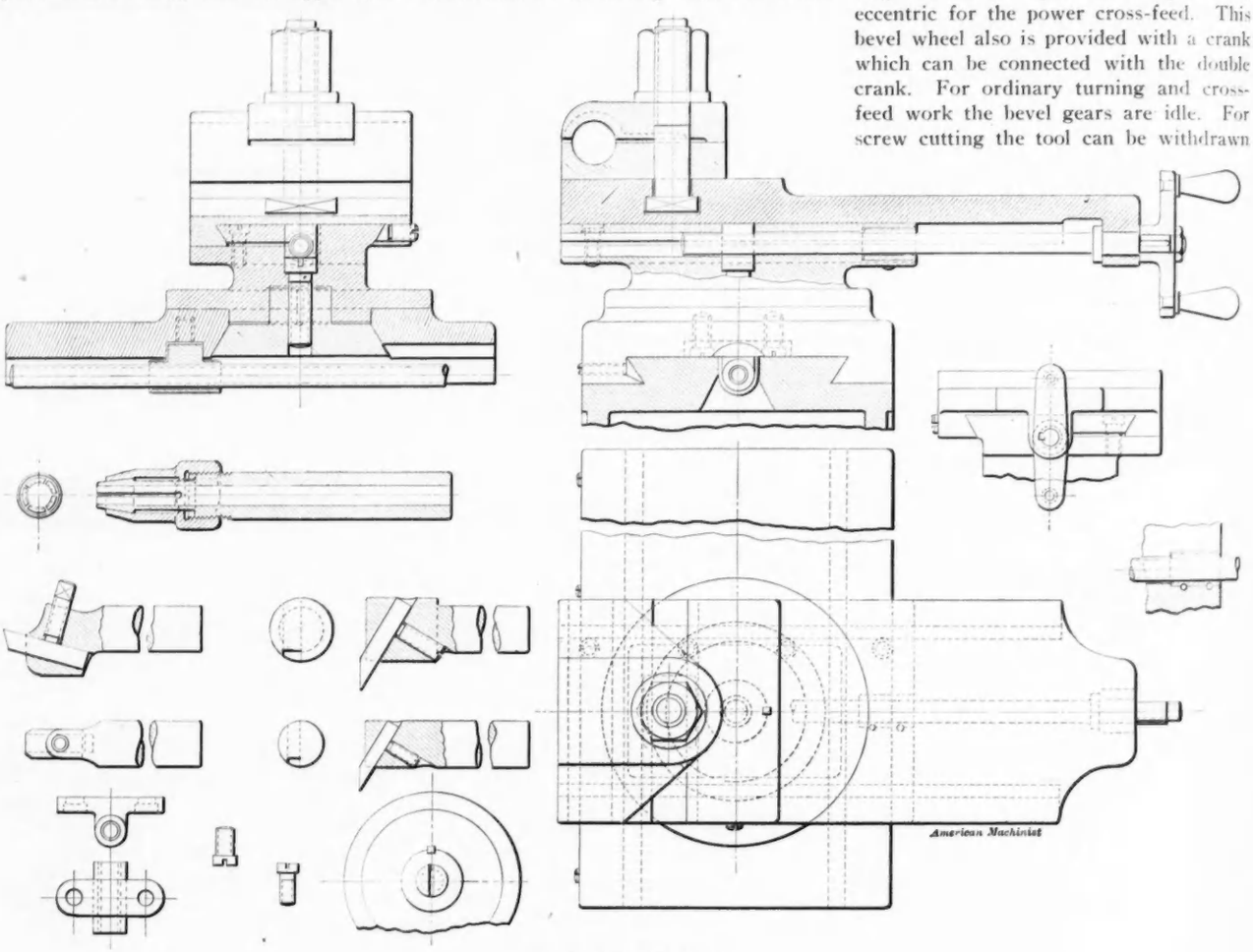


FIG. 5. THE CARRIAGE.

This lathe has also an arrangement for throwing out the feed of the carriage at any desired point. A disengaging lever is pivoted on a bolt on the left side of the bed under the right and left adjustment of the lead screw. This lever has a projection on its upper end which engages in the pin-hole of the joint lever on the right and left adjustment of the lead screw.

Under the front "V" on the bed a small round rod is fastened, which passes through one eye of the carriage, and on which is fastened a collar with set-screw and which can be adjusted at will. The front end of this rod strikes on the disengaging lever. The collar is then adjusted so that the carriage in moving strikes against it at a certain point. By this means the rod is made to move and to force the disengaging lever, and consequently the joint lever also, out of position; a draw-spring then throws this lever, as soon as it is loosened, into the middle position. By this means the operation of the lead screws is not stopped, but the whole of the change gears, together with the right and left-hand mechanism of the lead screw are put out of operation.

The footstock, Fig. 3, as was said, travels on the rear "V" of the bed and on the rear bearing surface of the beam. It is clamped to the beam by a cam on the inner end of the oblique spindle projecting at the rear. The tail spindle is a dovetail slide operated by a screw parallel with it and at the rear of it. The center is inserted in an eye in the front end of a dovetail cross-slide at the head end of the main footstock slide. The end of the slide is split a sufficient distance for clamping the center-carrying cross-slide. The usual "setting over" of the footstock, for turning taper or for correcting the alinement, is here done by moving the cross-slide of the spindle.

The steady-rest, Fig. 7, is supported on the same bearing surfaces as the footstock, and is clamped to the beam in the same way. It consists of a stand carrying two vertically adjustable arms with steel jaws, which can be moved toward each other or apart by screws at the rear. The arms, when thus set to the desired diameter, are clamped by set-screws to the stand. When machining quantities of similar work, the upper arm only is slackened and moved upwards by the screw; when the work is changed, the arm is run down again to its correct position and fastened.

The follow-rest, shown at the right of Fig. 7, stands in an inclined position and is fastened to the carriage. It has a slid-

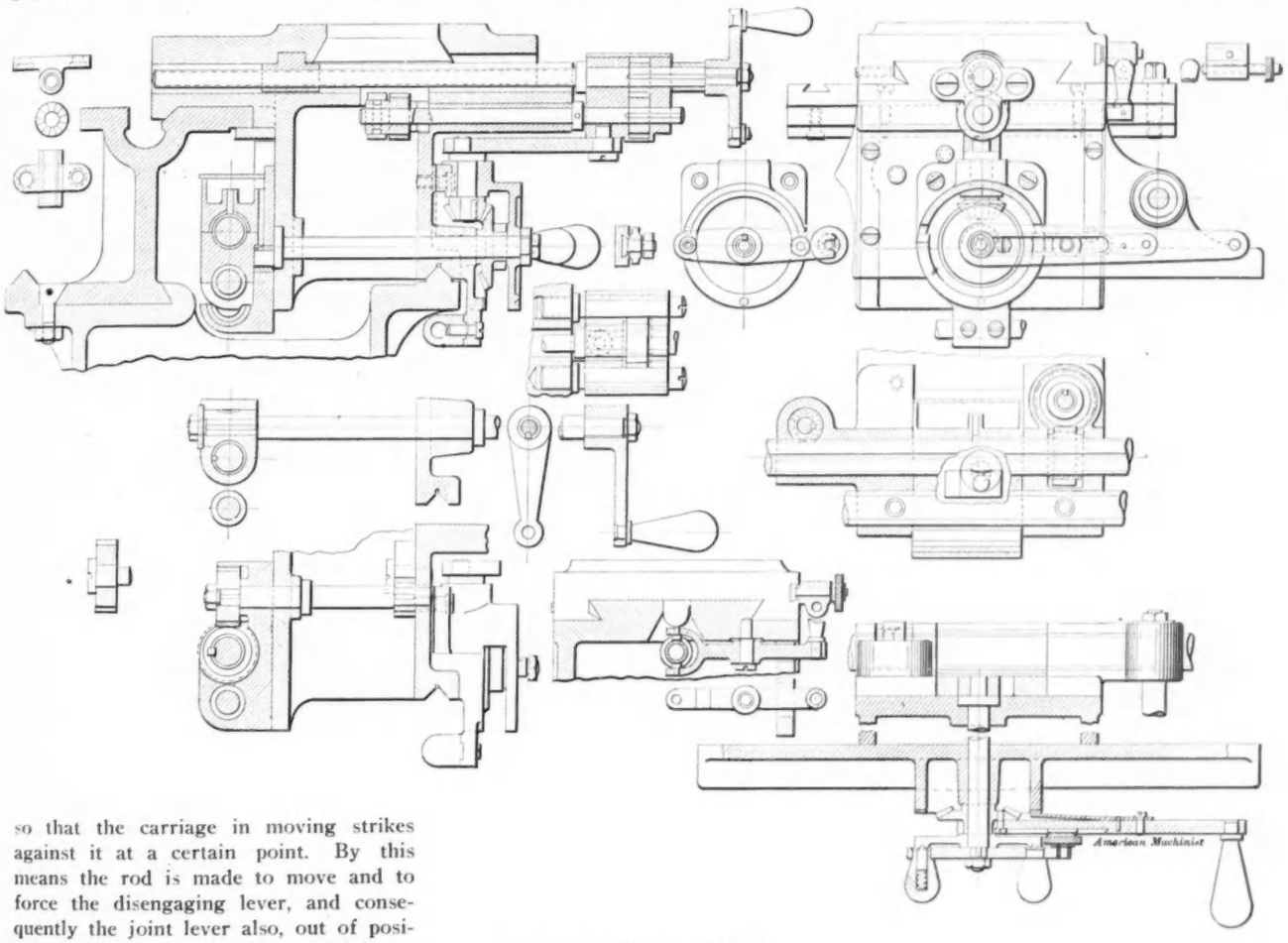


FIG. 6. DETAILS OF CARRIAGE.

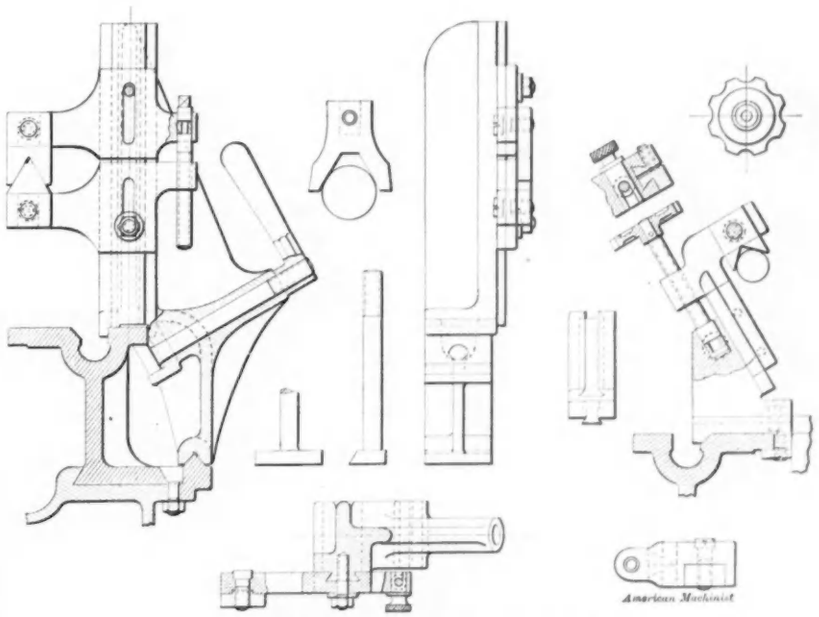


FIG. 7. BACK REST AND TRAVELING REST.

ing block carrying a hardened-steel "V" in which the work runs. This block also is moved up and down by a threaded spindle. A pin allows the sliding block to be quickly loosened and removed.

The countershaft of this lathe, Fig. 8, is as novel as the rest of it. It comprises a plate, which may be fastened to the ceiling by screws or bolts, and from this hangs an adjustable column on which an arm or yoke can be moved vertically. The yoke carries the countershaft with the cone pulley and the two loose pulleys. The former, which is at the side of the latter, is not shown. In the enclosed space between the two loose pulleys there is a small disk, as in the headstock, with wedges and clutch rings, only that in this case the face-plate is secured to the shaft. By moving the shaft in one direction or the other, the disk may be coupled to either of the loose pulleys at will. This movement is effected by a lever device operated by the workman from below. On the front of the arm a cross beam is fastened, which serves to prevent the arm from springing, and which also carries an extension with a loose flanged pulley. The belt from the shafting is led to one of the loose pulleys of the countershaft, then to the pulley on the extension, next to the second loose pulley on the countershaft and then back to the shafting; the one belt thus driving the two loose pulleys in opposite directions. The mobility of the arm and the hanging column permit the adjusting and tightening of the belt while running. Provision is made for the constant automatic lubrication of the loose pulleys and bearings.

In the half-tone, Fig. 1, near the headstock, is shown a rest for hand-tool work, which requires no explanation. It is supported by the same slides as the carriage.

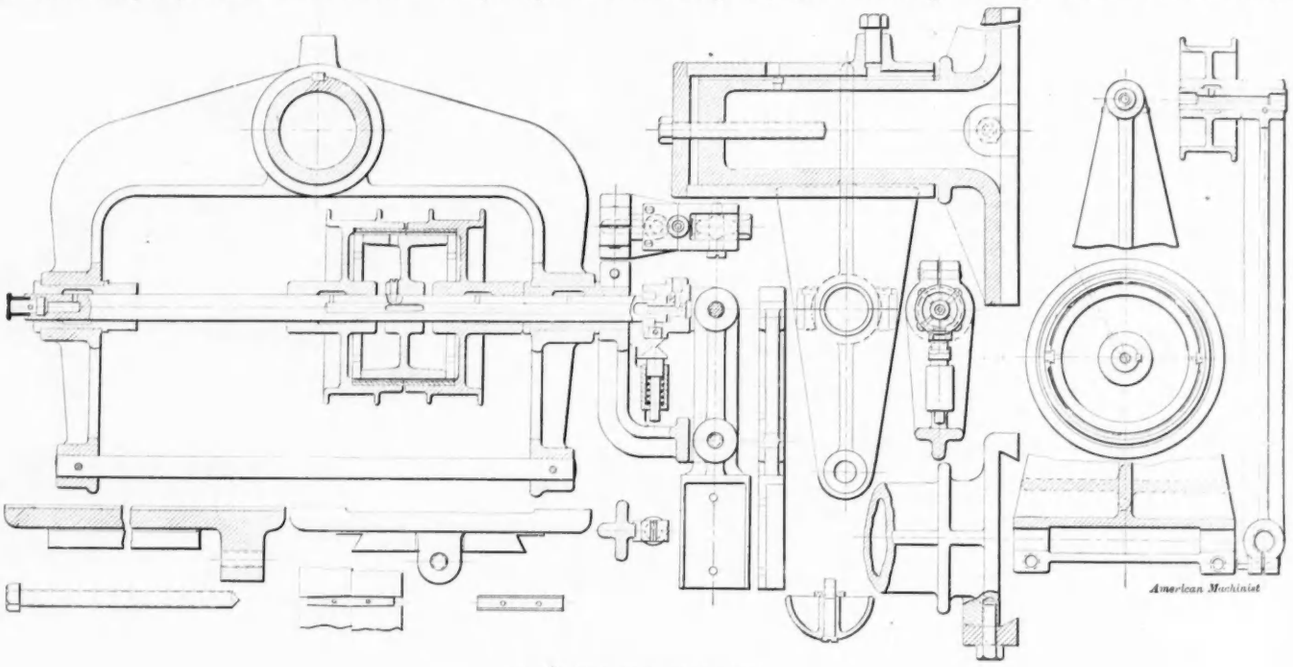


FIG. 8. THE COUNTERSHAFT.

Result of Exhibiting at Paris.

"American Trade," the organ of the National Association of Manufacturers of the United States, has asked for expressions of opinion from a number of American exhibitors at Paris as to the results of exhibiting there; whether it pays to exhbiit in such expositions or not, etc., and as might be expected gets replies that vary so much as to make what might be called the composite answer very inconclusive. P. E. Montanus doubts if the expense entailed is justified; the Morse Twist Drill and Machine Company say it is always hard to tell what the results are, but that they expect the expense will prove to have been justifiable. The Q & C Company say the results have been satisfactory, sales have been made and agents toned up; J. A. Jeffrey, of the Jeffrey Manufacturing Company, thinks the exhibition will increase the prestige of American goods, thinks whether such exhibitions pay exhibitors or not depends upon what they exhibit and does not believe in too frequent exhibitions. Several exhibitors criticise the arrangement of the classification of exhibits and C. A. Moore, of New York, says in effect: that while he believes the general results to American exhibitors will be good they might have been more so had American manufacturers generally understood how to manage and care for their exhibits as his firm did at Philadelphia and Chicago. We are not quite sure—but perhaps it makes no difference—whether he refers to Chicago or to Paris when he says: "I was really astonished to see the dense ignorance and indifference shown by a great many reputable concerns in placing splendid exhibits there, and then calling away the best men who installed them and were familiar with them and leaving the exhibits almost deserted. I could proceed on this line and name a great many features that I think are seriously neglected by practical men in carefully following up the possibilities of trade from such fairs; and they [*i. e.*, the neglected features] are not infrequent by any means, but are the rule rather than the exception."

Some Questions for Foremen, Draftsmen and Managers.

The following list of questions we take from "The Engineer," London. They are editorially said to be given "in order that our student readers may form some idea of what they do not know, and are not likely to know unless they take particular trouble to obtain the information." The questions are typical of those which are coming up continually in practical shop management, and which no school preparation alone gives the means of readily solving. The questions of course relate, as explained, entirely to an English "works."

In a certain establishment in the Midlands, one department is devoted to the construction of steam engines, and gives employment to 190 to 220 men, according as trade is good or dull. The whole of the turning, fitting, erecting, etc., is done under one roof, the erecting span being at the end of the fitting shop. The foundry is close by, so is the smithy. The engines made are from 25 to 500 horse-power. The latter are the exception. They are all stationary engines, for mills and electric-light works. They are simple, compound and triple expansion and are all good engines, the firm enjoying and greatly valuing a high reputation. The greater number are about 200 horse-power for electric-light work; some are horizontal, some vertical. The highest speed is 200 revolutions per minute.

(1) Give a list of the machine tools that can be economically employed in this shop.

(2) The cost price of each tool.

(3) What would the annual output weigh?

(4) What proportion of turners, fitters and erectors would be required?

(5) About how many molders could be kept regularly employed?

(6) What would be the weight of pig iron used per month?

(7) What brands would be used?

(8) What would be the cost per ton of fettled (cleaned) castings of various weights?

(9) How much coke would be wanted per month?

(10) How much lime, molding sand, blacking, fire-clay and fire-bricks?

(11) How many hearths (fires) would be needed in the smiths' shops?

(12) About how many hundredweight of bolts and nuts would be wanted per year, and what is the price of such things bought in the rough?

(13) Tenders are wanted for three horizontal compound engines to indicate 300 indicated horse-power each, with 120 pounds steam, and jet condensers. The engines must be guaranteed not to use more than 17 pounds of feed water per indicated horse-power per hour. The price of these engines is £30 a ton. What will they weigh?

(14) They are Corliss engines. There is reason to believe that a rival will tender at a lower price. It is essential to reduce the cost of the engines without risking the guarantee. How is this to be done?

(15) What is the price of leather belting per pound?

(16) How many pounds of belting would be required in the shop with which we are dealing?

(17) What is the price of files?

(18) What should the average bill for files be?

(19) The buildings are lighted with gas at 2 shillings per 1,000 feet. About how many burners would be needed, and what would the annual gas bill be?

(20) What would be a fair sum to allow for small stores, such as waste, oil, red and white lead, etc., etc.?

(21) What would be a fair price to pay, piece work, for turning out of the forging a crank pin, 6 inches diameter, 14 inches long, with two collars, and slightly tapered to fit a crank disk?

(22) What is about the finished value of a three-throw crank shaft—slabbed—in steel, 10 feet long over all, for a horizontal compound engine indicating 250 horse-power at 100 revolutions per minute?

(23) What would it cost to send an engine by rail 100 miles, and half a mile by road, and to put it on its foundations? Only a "three legs" and a couple of crap winches are available at the place where it is to be erected.

(24) What would paint and painters cost per annum in such a shop as we have described?

These are only a few examples of the kind of problems which any competent manager will have to solve in the course of his operations.

The Krupp Interests.

The statistics given herewith of the magnitude of the cast steel and other Krupp works are from the annual report of the Chamber of Commerce of the District of Essen, and were transmitted to our State Department by Consul-General Richard Guenther.

They comprise the following: Cast-steel works, at Essen; Krupp steel works, formerly F. Asthöwer & Co., at Annen, in Westphalia; the Gruson Works, at Buckau, near Magdeburg; four blast furnaces at Duisburg, Neuwied, Engers, and Rheinhausen (this latter consists of three furnaces with a capacity for each of 230 tons per twenty-four hours); a foundry at Sayn; four coal mines (Hanover, Saelzer, Neuack, and Hannibal), with interest in other coal mines; more than 500 iron mines near Bilbao, in northern Spain; shooting grounds at Meppen, with a length of 10⅝ miles and a possibility of extension for 15 miles; three ocean steamers, several stone quarries, clay and sand pits, etc. In addition, the firm of Frederick Krupp operates the Ship and Machine Stock Company Germania, at Berlin and Kiel, under contract.

The most important articles of manufacture of the cast-steel works at Essen are cannons (up to the end of 1899, 38,478 had been sold), projectiles, percussion caps, ammunition, etc.; gun barrels; armor plates and armor sheets for all protected parts of men-of-war, as also for fortifications; railroad material, material for shipbuilders, parts of machinery of all kinds, steel and iron plates, rollers, steel for tools and other purposes. The steel works in 1899 operated about 1,700 furnaces, forge fires, etc., about 4,000 tool and work machines, 132 steam hammers of from 200 pounds to 5,000 metric tons force, more than 30 hydraulic presses (among them 2 of 5,000 tons each, 1 of 2,000 tons, and 1 of 1,200 tons pressure), 316 stationary steam boilers, 497 steam engines with an aggregate of 41,213 horse-power, 558 cranes of from 400 to 150,000 tons lifting power. During the last year, the iron mines yielded an aggregate of 1,877 tons of ore per day. The coal production from the mines belonging to the Krupp Company (excepting the Hannibal) amounted, on an average, to about 3,738 tons for each working day.

The consumption of coal and coke in 1899 was as follows: In the cast-steel works at Essen, 952,365 tons; in the other works and on the steamers of the company, 622,118 tons; in all, in round numbers, 5,000 tons per day. The consumption of water at the cast-steel works in 1899 was 15,018,156 cubic meters, which equals about the consumption of the city of Frankfort with 229,279 inhabitants. The consumption of gas in the steel works at Essen was 18,836,050 cubic meters in 1899.

The electrical power plant of the works at Essen has three machine houses with six distributing stations, and supplies 877 arc lights, 6,724 incandescent lamps, and 179 electric motors.

For the traffic of the works, railroad tracks of standard gage of about 36 miles are laid, which connect with the tracks of the main railroad station at Essen. Sixteen locomotives and 707 cars are operated on the grounds. In addition, there are narrow-gage tracks of 28 miles, with 26 locomotives and 1,209 cars.

The telegraph system of the steel works has 31 stations, with 58 Morse telegraphic instruments and 50 miles circuit. The telephone system has 328 stations, with 335 telephones and a circuit of 200 miles.

On April 1, 1900, the total number of persons employed in the different works was 46,679, viz., 27,462 at Essen, 3,475 at the Gruson works of Buckau, 3,450 at the Germania works at Berlin and Kiel, 6,164 in the coal mines, and 6,128 at the blast furnaces and on the testing grounds at Meppen, etc.

An Electromobile Call.

There's a story being told at the expense of a well-known man who calls frequently upon an equally well-known young woman who is summering at Arlington, near the Country Club, at Columbus, Ohio.

The gentleman, so the story goes, engaged an electric automobile for the trip one afternoon last week, and, armed with a new book, a box of candy and a bunch of roses, went speeding out Fifth avenue for a long afternoon visit.

Just as the turn was made on the road leading toward the club, the manipulator of the automobile discovered that some trifling disarrangement of the brake would prevent his stopping the machine. It sped along, notwithstanding the call of the passenger to stop at the first house on the right.

Finally the motorman was forced to confess that he could not stop until the electric charge in the storage battery had exhausted itself.

That seemed funny enough for the first trip or two around the block, but riding about in a circle, under the circumstances, got exceedingly monotonous after a while.

Then the young woman, it is said, became curious and was at a loss to understand why her caller preferred to ride aimlessly around in that fashion. She went to the front door and down the road, in answer to the gentleman's signal.

He explained the best he could as the automobile flew past, and after a half-dozen more turns she began to understand the situation.

It seems the battery had two hours more to run, and if it all ran out at Arlington there would be no way of getting the ma-

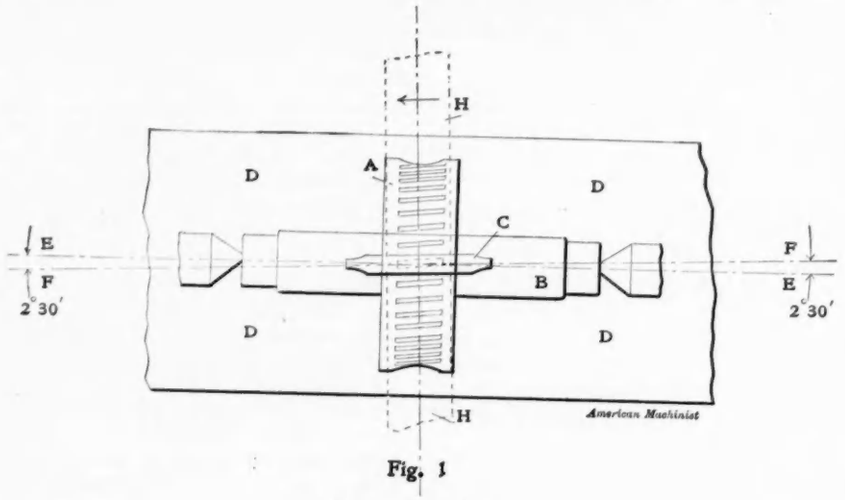


Fig. 1

GASHING THE BLANK.

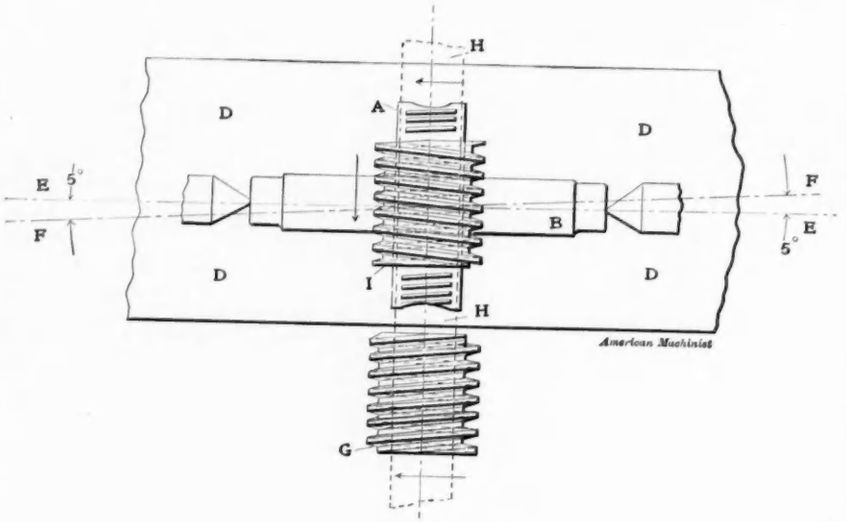


Fig. 2

HOBBING THE WHEEL.

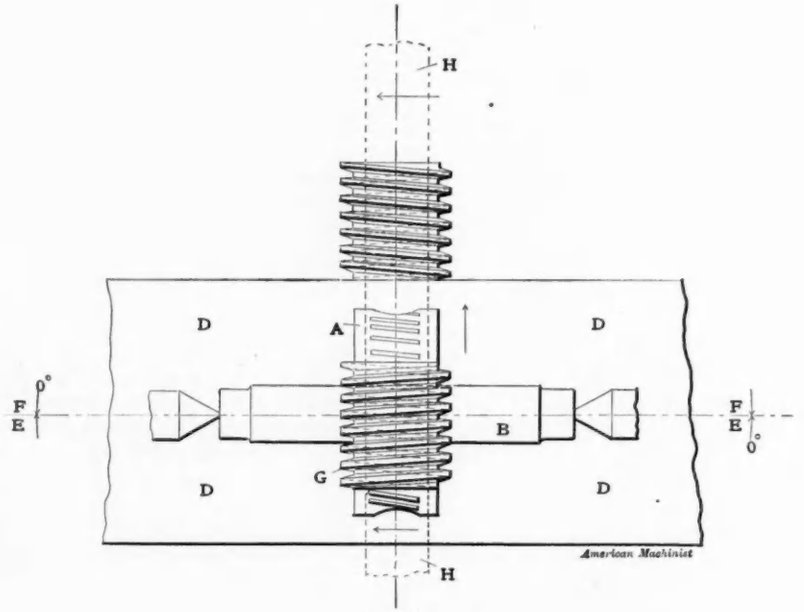


Fig. 3

TESTING THE WORK.

chine to town. Then they arranged a sort of railroad station mail-catcher plan and the gentleman passed out the book, then the candy, and finally the roses to the young woman as the vehicle whizzed past her.

It took a trip for each article and a few more trips to say goodby, when they were warned by the operator that he must start for town or risk being stranded somewhere without motive power.

A few farewell waves, and amid the amused shouts and laughter of the Arlington resorters, who had gathered by this time, the disobliging and obstreperous machine disappeared over the hill toward town.—Cincinnati "Commercial Tribune."

Hobbing a Right-hand Worm Wheel with a Left-hand Hob.

BY A. B. CHRISTMAN.

Having lately to hob a right-hand worm-wheel with a left-hand hob, and having succeeded admirably, in spite of considerable skepticism, of which I contributed a generous share, I will try to describe the operations by the aid of Figs. 1, 2 and 3. We were furnished a hob of .250 inch pitch, 1.875 inch diameter, single thread, left hand, and a worm-wheel blank, which was to be hobbed right hand, and the worm.

Having ascertained that a No. 6 12-pitch spur gear cutter we had would do for roughing, and that the pitch angle was approximately 2° 30′, we performed the operation shown in Fig. 1, which is only valuable as showing the direction in which table was swiveled to obtain the pitch angle; *F* being the normal center line of milling machine table, *E* the position when swiveled, *D* the table, *A* the blank, *C* the cutter, *B* the arbor through worm, and *H* the cutter arbor. Finding that the hole in worm *G*, Fig. 2, was slightly larger than the hole in hob, we mounted both on the same arbor, using the worm as an arbor collar,, enabling us, by throwing platen swivel to zero, to draw cross-slide forward so as to allow worm to engage, while revolving, with partly hobbed wheel, and thus ascertain if angular setting was correct. This was important on account of worm and hob being of reverse angles.

In Fig. 2 hob *I* is shown in operation, also that table is swiveled to an angle of 5 degrees, or twice that in Fig. 1, *and in the same direction.*

In Fig. 3 is shown worm *G* engaged with wheel *A* for running test, and in position as it was to run when finished and in place on machine in which it was to be used; platen swivel being at zero. The arrows show the direction of motion of worm-wheel and cutter arbor, the latter being the same in all operations.

It might be claimed that by this method the wheel could not be cut technically correct, and I am prepared to admit the correctness of the contention, having only to say that this was done in actual practice,

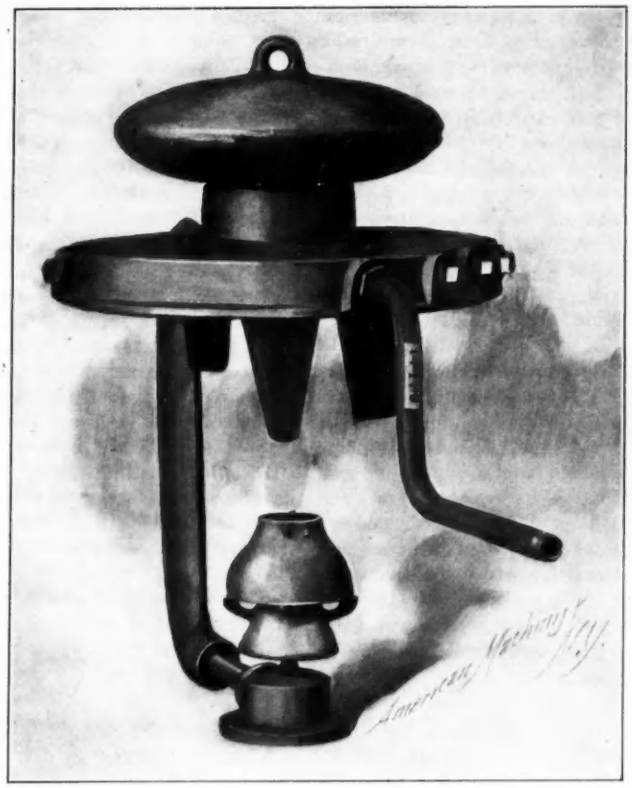


FIG. 1. A FUEL OIL BURNER.

made a job in every way satisfactory, made possible the shipment of order on promised time, and saved the price of a hob.

A Fuel Oil Burner.

The accompanying illustrations show a new fuel oil burner, which we are informed has been successfully made in sizes up to 100 horse-power and of a degree of flexibility, such that they may be used down to one-tenth of their full capacity.

The systems of burners which have been most successful in the past are the atomizing and volatilizing systems, of which the former is most used for large burners and the latter for small ones. In the atomizing system the oil is sprayed into the firebox by a jet of steam or compressed air. While this style of burner is in quite successful use, it has its disadvantages, chief of which are the intense blow-pipe action of the flame and the roar which accompanies its action.

In the volatilizing system the oil is forced through a coil of pipe which is kept hot by the flame and by which the oil is vaporized before it reaches the burner. The chief difficulty with this style of burner is that when forced, the coil becomes overheated, in consequence of which instead of merely volatilizing the oil a portion of it is changed to a fixed gas, some of the carbon being left behind to clog the coil and burner orifices.

The burner under description is of the volatilizing style, but with improvements intended to obviate this difficulty, and having also the addition of a re-igniting device by which the flame is automatically re-lit in case it becomes extinguished from any cause. This is intended not only as a convenience, but as a safeguard against the accumulation of explosive mixtures of air and gas in the firebox, generated while the volatilizing coil is still hot.

Fig. 1 shows the burner complete, and Fig. 2 is a sectional view. The volatilizing coil is seen above the burner, its location being such that it is in the blue or cooler portion of the flame, where the heating effect does not increase so rapidly with the rate of combustion as it does farther up. In point of fact, owing to the increased cooling effect of a large over a small supply of oil, the coil is kept at a somewhat lower temperature with a large blaze than with a small one.

The burner itself has two orifices which, when the burner is not in action, are kept closed by the weight of the other parts. The weights are so disposed that if a small amount of vapor is turned on, the upper orifice *a*, Fig. 2, first opens—this orifice being of such size as to give little more than a priming blaze. With a larger supply of vapor the cones surrounding the tips are raised by the pressure of the gas below the lower orifice *b*, the amount of opening adjusting itself automatically in accordance with the pressure. A small fluted stem rises within the central sleeve of the cone, and guided by this stem, the cone floats on the current of oil vapor—inclined wings *c* and *d* acting like the vanes of a windmill, to cause the cone constantly to revolve and thus keep the orifices clean.

The re-igniting device is exceedingly simple—a hollow combustion chamber *e* filled with particles of broken fire-brick with a connection through the center of the generator by a taper tube through which part of the burning vapor passes. In a short time the igniting chamber becomes a glow of incandescent fire-brick, which will remain hot long after the fire

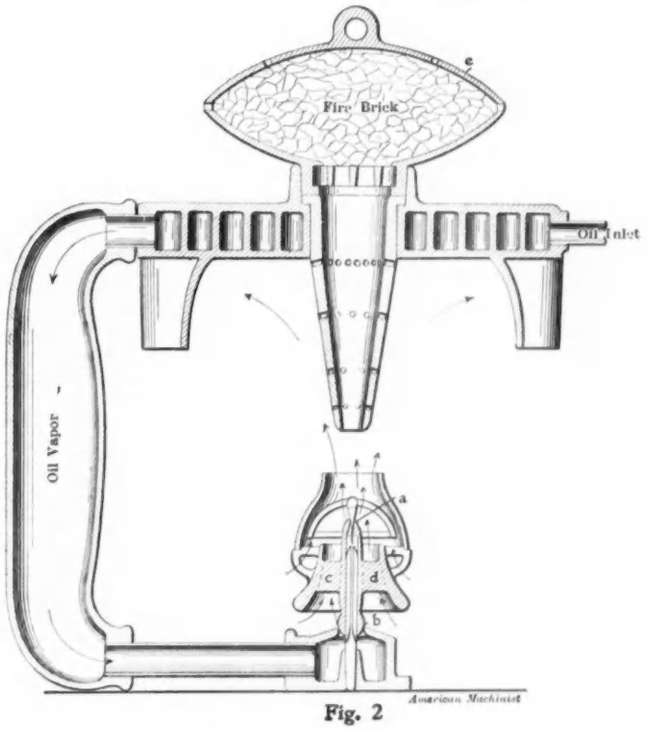


Fig. 2

SECTION OF THE BURNER.

becomes extinguished. Supposing the flame to be accidentally extinguished, the first escaping hydro-carbon vapor that leaves the nozzle, passes up into this combustion chamber, becomes superheated and ignited by the incandescent fire-brick, explodes down the tube to the source of the escaping vapor, and thus ignites the flow. The larger burners have been known to reignite 15 minutes after the fire has been extinguished.

To operate the burners simply requires a stand column or an air or water pressure behind the oil in a tank sufficient to cause it to feed through the weighted nozzle. The size of the fire is regulated by the amount of oil allowed to flow into the generator.

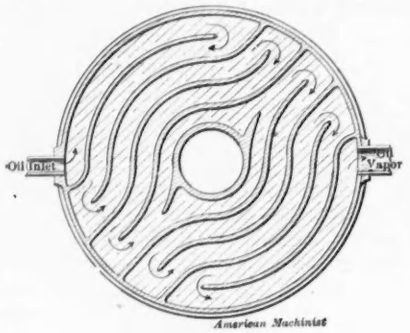


Fig. 3

SECTION OF VOLATILIZING COIL.

The small burners will keep lighted and burn a blue flame with a feed of one drop per minute. They are self-starting, by simply allowing a small portion of the oil to overflow in the base, and lighting with a match, when in about three minutes a clear white flame will appear.

With the larger sizes a small burner is placed under the generator, starting at full head requiring from ten to thirty minutes, according to the size of the burner.

The burners are designed to burn kerosene oil and petroleum residue, or fuel oil.

Fig. 3 shows a plan section of the volatilizing generator. The leading uses to which the burners have thus far been applied are to steam launches and automobiles. They are the invention of Henry A. House, and are made by the Liquid Fuel Engineering Company, of Bridgeport, Conn.

A Punch and Die for Reducing Brass Tubing.

BY C. H. ROWE.

This paper is to present to the readers of the "American Machinist" sketches and information concerning a punch and die, for reducing the ends of brass tubing, as developed by practical experience. The means shown for reducing the tubing consist of a die and punch with a combination of self-contained mechanical movements that can only be used in a press where the ram is at a considerable distance above the bed, and which, moreover, has an unusually long stroke; the travel of the ram in this case being sufficient to permit the easy removal of work 3¼ inches long. The tubing used in the above die has an outside diameter of .578 inch and is reduced for one inch on the end to .471 inch. The walls of the reduced part are slightly thickened and the density of the metal is somewhat increased by the operation; the length remaining unchanged. The work from a die of this kind is uniform as to outside diameter and length, a variation being noticeable on the inside of the reduced part.

In the accompanying drawings, Fig. 1, is a plan and section of the die. *A* is the cast-iron bed, finished all over and with a way planed longitudinally to accommodate the hardened and ground slides *B*. The pieces before hardening are temporarily doweled together and indicated on the face-plate of a lathe, the center of the hole being located where the ends of the slides come in contact, and hole *C* is machined and polished to size. The slides, after the lathe work is done, are made as hard as possible by heating and dipping in a salt-water bath and not drawing them. The inner face of the slides are touched up on the surface-grinding machine to remove any imperfections caused by hardening and to insure their coming together perfectly, more particularly near the edges of the hole *C*, as the mark of any opening here would be plainly visible on the finished work. The pieces are again doweled to each other and the reduced part of the hole *C* is lapped to the desired size. From beneath it is enlarged .002 inch above the size to within about ⅛ inch of its top, to avoid surface friction when the tubing is forced down, as it was found to be impossible to make the die work satisfactory with a long straight hole. *D* is a stud hardened and driven into base *A*. The space between the wall of the hole *C* and the stud is the thickness of the tubing plus .004 inch.

The outer ends of slides *B* are beveled at corners *E*—45 degrees. Near the bot-

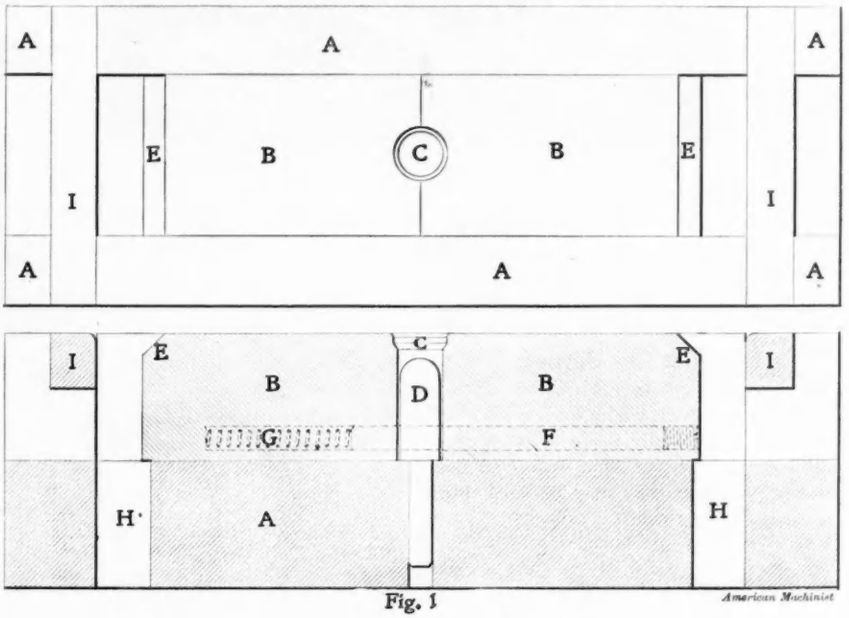


Fig. 1

PLAN AND SECTION OF DIE.

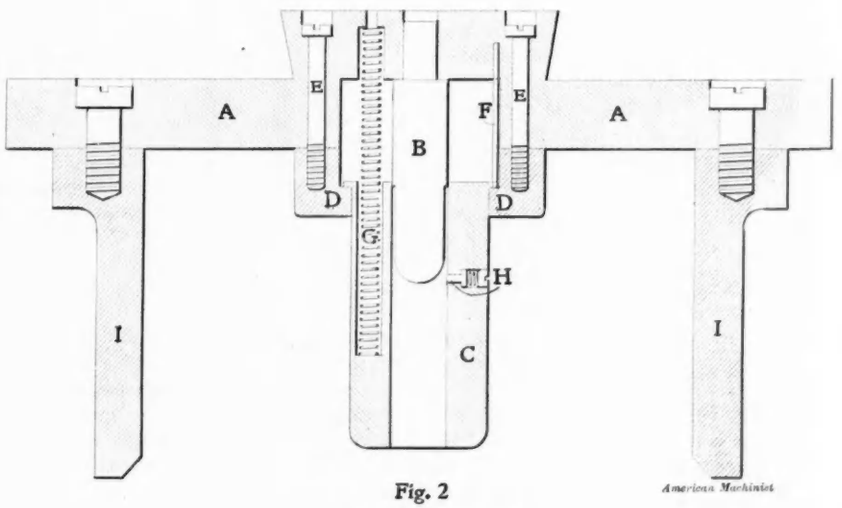


Fig. 2

SECTION OF PUNCH.

tom of the slides on each side of the hole *C* are ¼-inch guide pins, *F*, to prevent the possibility of their being out of line when closed up should they chance to fit the way loosely. The pins are retained in place on one end by screws, and in the opposite piece are springs *G*, one only being shown, to open the slides when the punch has ascended clear of the die. At convenient points in the vertical walls between which the slides operate are placed ⅛-inch pins to prevent their being separated more than is necessary to permit the easy removal of the work from the die. The slides are held down in proper position by flat pieces of steel ¼ inch thick screwed to the top of the base *A* on the sides.

The cored holes *H* are for the ends of the studs *I* on the punch to enter after passing the guides. The oblong pieces of hardened steel, *I*, are let into the base of the die, and retained by screws from beneath (not shown), to sustain the studs on the punch and to avoid any springing outward, in consequence of their length, which would be apt to occur when the tube was forced down in the die. Any imperfect workmanship can be discovered by an examination of the reduced end of the work, as any giving away of the slides permits the tubing to flow out in the opening, where they come together.

Fig. 2 shows a section of the punch. *A* is the holder with a projection at the top beveled 10 degrees on each side and secured to the ram of the press by a wedge-shaped gib. In the center of the holder is driven the finished and hardened central punch *B*, its largest diameter being the same as the outside of the tubing, the lower end fitting the inside. Surrounding the punch *B* is a cast-iron cylinder, *C*, supported by the piece *D*, which in turn is fastened to the holder *A* by the two screws *E E*, and dowel pins to properly secure it. At equal distances around the circle are three long springs, one of which is shown at *G*, that hold the cylinder *C* down in its extended position when the punch is up and clear of the die, and cause it to press lightly on the face of the slides *B*, Fig. 1, when in operation. *H* is a spring pin to retain the work which is pushed up in the punch by the operator and stops against the shoulder on the central punch *B*. The ⅛-inch wire *F* is driven into the holder and prevents the cylinder turning and distorting the springs. *I I* are the fingers fastened to holder *A* by two ⅜-inch screws and guide pins in each. The lower inside corners are machined at an angle of 45 degrees, to correspond with the angles on the guides in the die.

The final problem for consideration was the setting of the punch and die, for a slight inaccuracy would result in the bending of the tubes, consequently proper alinement of parts was indispensable. To avoid the annoying work of getting the die set exactly in line with the punch each time that it was called into use, we turned a piece of steel 2½ inches long, one end fitting snugly in the hole *C*, Fig. 1, and the other part entering cylinder *C*, Fig. 2. With the use of parallels and clamps, we got the two parts in line, and drilled and reamed in the rear of the fingers *I I*, Fig. 2, two 1-inch holes, to which were fitted hardened pins that are always in position for adjusting and bringing in line the punch and die.

Lynn, Mass.

Letters from Practical Men

American Skill Momentum.

Editor American Machinist:

I was talking a little in the letter before this about the assumption—an erroneous one, as it seems to me—that technical skill is becoming scarce in the United States, so that, as they say, the supply of sufficiently skilled and reliable workers does not, or certainly will not, keep up with the demand. This is the premise from which our later schemes for technical education and training are taking their departure. It does not seem to me that they start right; and with the false start it will not be strange if they get farther and farther astray as they proceed.

Everybody seems to be willing to acknowledge, if they don't go much farther than that, that industrially we, as a nation, are, or at least have been, playing a winning game. We have been catching up with and passing them all in the race for industrial supremacy. Great Britain and the rest of them are inquiring how we have done it, and they are trying to catch on to our means and methods. The most natural and proper thing for us to do would seem to be to keep right along in the way we are going, trying at the same time to improve upon our own methods by first ascertaining what have been the special conditions which have proved most advantageous and helpful to us, and then by arranging for the further development of the proved means of success along the successful and familiar lines.

The strange thing is that this is precisely what we are not doing. Our success being acknowledged, and the method of it apparent, or at least easily discoverable, we are provided with imperative indications as to the proper course to follow, indications which we may oppose or disregard only to our undoing. There is an American way, and we have demonstrated to all the world and to our own satisfaction that it is a good way, and up to date the best way, and yet those who assume to plan our industrial future for us, and who would arrogate to themselves the positions of steersmen of our industrial craft, are proposing to turn us out of the good old way and to guide and urge us into a new and a very different one.

It is the announced intention to first of all narrow down the man to something of less scope than the machine which he is to operate. In buying a new machine tool, a lathe, a planer, a milling machine, a turret lathe, or what not, we very properly consider in detail each separate movement of the machine and the devices and arrangements by which they are all produced. In developing and improving the machine we think nothing so minute and insignificant that a change in it may not be to the advantage of the machine as a whole and to the increase of its output. We certainly do not forget the general function of each machine as the applier of force and motion to the accomplishment of some predetermined result. It has its driving pulley, its shafts and its gears, and we see to it that these are of adequate proportions. There is nothing so essential as that at the beginning of operations the machine shall take and transmit into itself all the power that it requires. No accuracy and reliability in the delicate movements of the machine will be of any avail if the machine doesn't go. If it only runs at half-speed, or intermittently or unsteadily, its work cannot be fully satisfactory. The best results will only be secured when the drive is all right.

Now, the man who is to operate the machine, or the man who still has some things to do which no machine has yet been contrived to do for us, is enough like a machine to be in some respects properly comparable with it, and no one need be offended by the comparison. The man must be able to do something, just as the machine is able to do something, by the action of some of its parts. In the machine the parts are usually of iron or steel, working together or so related that one moves another; in the man it is the bones and muscles that do the work, with the cooperation of eye and ear and all the senses, and with the blood and the nerves as the transmitters of the power. No more in the man than in the machine can the drive be ignored. Indeed in the man much more than in the machine is the drive the most essential part. No matter how the finger and the eye may be trained to nicely cooperate, no matter how fine may be the skill, how facile and rapid the execution, there must in the man be motive and impulse, just as in the machine there must be the rotative force transmitted to it by the belt. The excellence of the American workman, his superior or more prolific accomplishment as such, his persistency in devising better ways of doing things, and in finding many more things to do, his development often into the planner for and driver of others, have been due to the way in which he has himself been driven. The failure to recognize that the drive of the man is at least as important as his lubrication and adjustment, is the mistake of the times. It is a most unmechanical proposition, a complete ignoring of the relation of cause and effects, that one who is to be only a skilled worker in a factory does not need much of a general education.

The general education of the masses has been the secret of American success thus far, although there is no secret about it. Life has here been better worth the living and work has here been better worth the doing, and consequently more and better work has been done by the individual worker, because his mind and heart have been better fed and hope and determination have not been starved.

I hope that everybody read that account of the two apprentices in the oil country in the "American Machinist," No. 39. I am happy to believe that Sam rather than Joe was the typical American. It needs not to be said that he was the fellow who had the broader education, that he would develop into the larger man, that he would be the more helpful in his day and generation. That he would be through life the most contented man I will not assert, and it matters not. TECUMSEH SWIFT.

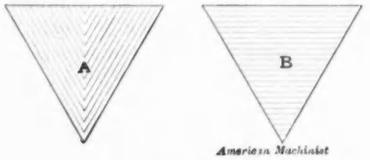
Oil on Taps and Reamers in Cast Iron.

Editor American Machinist:

That inquiry of Mr. A. P. Brush, about whether or not to use oil on taps and reamers in cast iron, is apparently a very simple one, and yet it is one that will stand quite a lot of talking about. It is one upon which we should of course easily agree, and yet it is certain that we will not agree upon it. For myself, I would not use oil with a reamer in cast iron, but I would certainly use oil with a tap. I have always used reamers dry in cast iron, and with very satisfactory results. I must confess that I have never tried oil with a regular, clean-cutting, fluted reamer, and I don't believe I ever thought of trying it. A reamer usually has very light scraping to do, and I know how a flat planer tool will act in taking a thin scraping cut if it comes to an accidental grease spot or a drop of oil on the surface. Things will have to be very rigid, or the tool will lose its cut at the spot. Much more pressure is required to hold the scraping cut to its work if the surface is oiled than if it is dry, which means that the cutting edge must wear faster and that the surface cut will rise or spring back more after the scraping edge has passed it, or, in the case of a reamer in a hole, the same reamer should make a somewhat smaller hole with the oil.

My experience has developed more positive convictions about the use of oil with a tap in cast iron. I don't know whether my opinion here is consistent with the other or not, but I certainly believe it more firmly. When I began tapping holes in cast iron I used oil on the tap because everybody else then did, as far as I knew. In the course of events it naturally came in my way some time to try the tapping of holes in cast iron without oil. I tried it "to my heart's content," as the saying is; but it was rather to my discontent, and I soon dropped it. You can't cut a neat and smooth thread in cast iron without oil, even if the tap is run right through the hole, as in tapping nuts, and if the tap has to be backed out, then there is the—what's his name?—to pay.

There may be tapping conditions under which it may be possible to do as well, or better, in tapping without oil, but I never happened to strike them. There are two very different ways of cutting V-threads, both inside and outside, and it must make some difference about the use of oil as to which style of cutting is employed. In the style *A* in my sketch, where the tool is always a perfect "V," the chips have a hard time of it in getting away from the work. They can't roll right square and clear away from the surface that is being cut as in style B. The chips, as they leave the sides of the "V" have to do so with a kind of sliding or sluing movement, and the two sides of the chip also struggle against each other in such a way that it must add to the pressure on the tool to overcome it. With this complicated movement of the chip, and the friction and crushing and bending resistances encountered by the cutting point, the matter of lubrication must be an important one, and it seems evident that oil must be a help, both as to the smoothness of the cut and as to the power required.



THE TWO WAYS OF CUTTING V-THREADS.

Where the thread is cut not by a V-point, but by a succession of flat-ended tools, as in *B*, the chip rolls away in the easiest and most natural way possible; so that if lubrication is still required, it certainly is not so requisite as in the other case. I can, indeed, imagine a case where, in this style of thread cutting, the cutting conditions of the reamer are nearly reproduced, and where it would be possible to argue against the use of oil, as with the reamer. In the case of a long machine tap, such as is quite commonly used for tapping nuts, where the thread is first cut perfectly parallel and then the tops of the teeth are flatted off by a long taper, this taper may be so long, and the increase of diameter from one tooth to the next may be so slight, that it may not give a chip of sufficient thickness for the tool to hold it, and then if the flat cutting, or rather scraping, edge was perfectly dry, it would take hold and retain its hold better. The taper on this style of taps has often been made too long. If the taper is shorter, so that each successive tooth can take a proper cut, then the oil will do it good.

It is a curious thing what a difference it makes, in cutting wrought iron or mild steel, whether it is cut dry or whether water is used. The smoothness of the water cut compared with the roughness of the dry cut is to me marvelous. I was talking with a fellow about this the other day. What we were really talking about was the cutting tools that they use at the Bethlehem Steel Works, that they say cut just about as well when they are red-hot as when they are cold. It was remarked that even these tools do not despise water, and will do considerable more if a good stream of water is kept running on them. And then we were talking about using water in turning and planing cast iron as well as with wrought iron and steel, and we were wondering why they don't do it. Why is it? Who knows? I do not remember that I ever tried it or saw it tried. Why is not water used in turning cast iron. It may be because the iron will rust so badly, but that we could get around by using soda water. Is there some bigger reason? MORRIS FULTON.

Philadelphia.

Editor American Machinist:

Mr. A. P. Brush, in issue No. 39, asks for opinions regarding the use or non-use of oil in tapping and reaming holes in cast iron, believing that there are some for and others against the practice. The use of oil nearly cost me my job once. Having served my time in a modern and well-known shop, where they manufacture a special machine tool of a very high grade, and having been taught to use a very small amount of oil when either tapping or reaming a hole, I considered that it was the correct thing to do, and I found myself doing that way, from force of habit, in another shop where I had received employment. Now, this shop builds woolen machinery, and enjoys an enviable reputation in that line; but a fit there meant a 1-64 inch play, more or less, and when the foreman saw me using the oil, there was trouble for poor Charlie right away. Well, times were dull and a job was to be prized. Possibly I prized it more than I would have done, had I not just previously been out in the cold, piling logs on the top of the mountain. However, I succeeded in quieting the "old man" within me, and adopting the ways of the shop, I stayed through the winter.

It has been my experience that a small amount of oil not only makes the tool turn easier, but it enables one to do more uniform work, and I always use oil from choice. At one time I had a job of cutting fine V-threads in a lathe on the hub of a casting, and I found that if I used a very little oil on my finishing cuts I got a much smoother and nicer-looking job, as the point of the thread would not crumble away as it would when oil was not used. In saying that a tool will cut easier with oil, I feel like modifying that a little, as it might depend somewhat on the condition of the tool.

The next shop I went to, after the experience above related, I was given a lot of cast-iron pulleys to bore and ream, and I very timidly asked if I should use oil in

reaming, and was told not to use it. It was lucky for me that I did not try, for "that reamer has been used especially for that job for about fifteen years, so as to keep the bore in all those pulleys the same." The result of that fifteen years of service had been to wear away all cut the reamer ever had, and it simply ground or tore its way through, with an accompanying noise that would rival the music of an Arabian band. I do not believe I could have forced the reamer through if I had used oil; in other words, it would have "stuck." Still, that reamer was making the same size holes that it made "fifteen years" before. Do you believe it? I don't; but when I asked if it could not be sharpened I was told that it could not be, as it would change the size of the bore. I will not say anything further against the use of oil, but will leave it to the "other fellow," as I am sure he will show up.

CHAS. C. ABBOTT.

Editor American Machinist:

In your issue No. 39 Mr. A. P. Brush asks for the "opinion of some of the 'American Machinist's' practical contributors on the use of oil in tapping and reaming cast iron." While I am not a contributor in a practical or any other sense, I am a practical operator and observer in the working of metals. I find that oil has its use in both tapping and reaming. In the use of a reamer in a chucking lathe, the reamer will cut smaller if oil is used, and will also wear away much faster. The life of a reamer, as to holding its size, will be about one-half as long when oil is used instead of using it dry. This also holds good with taps used in the same way. I have made use of this fact on the chucking lathe when I have found a reamer cutting too large. I have given it a supply of oil. This has answered the double purpose of making the hole the right size, and of soon reducing the reamer in size so that it would cut right without oil.

Some time ago I had occasion to make a lot of cast-iron nuts with square thread, about 2½ inches in diameter. After cutting them out with a tool I had a sizer tap run through them. The operator started off using oil on the tap, but after he had them about half made, he thought the oil was unnecessary; so he finished the rest without the oil. When the screws were cut, the man got hold of some of the nuts that had been tapped with oil and fitted the screws to them. When the dry-tapped nuts came to be tried on, they were so loose that they could not be used and new ones had to be made. One would hardly believe that the same tap made both nuts, there was such a difference. My experience goes to show that the reamer or tap will hold its size much longer used dry than with the use of oil.

CHAS. BENSON.

Newark Machine Tool Works, Newark, N. J.

Calculating the Weight of Castings.

Editor American Machinist:

In calculating the weights of castings, the following methods may be found of use. They give results that come quite close to what the foundry will turn out, except in those cases where a large quantity of the same piece is required, and special precautions are adopted in flasks and molding to get a casting true to pattern.

Cast iron $\frac{\text{cubic inches}}{4} + 10$ per cent. = weight in pounds.

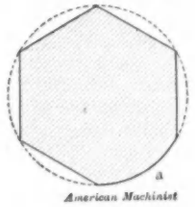
Cast brass and steel, cubic inches $\times .3$ = weight in pounds.

A. D. WILLIAMS.

Milling Flats on Drill Shanks.

Editor American Machinist:

Everybody knows that almost every drill with cylindrical shank held in an ordinary drill chuck will slip every now and then in the chuck and that this is the reason why the jaws of most chucks wear out so very quickly. Now I want to ask if nobody will mill flats on the small twist drills (between 5-32 inch and 7-16 inch). For holding them in Whiton and Beach chucks I



SECTION OF DRILL SHANK, ENLARGED.

am milling five flats the shanks as shown, *i. e.*, making them hexagonal except that one side (*a*) is left cylindrical as shown. The chuck is marked, and care is taken to have the side *a* always correspond to the mark on the chuck before chucking the drill. The result is important in a great saving of chucks and the drills will always run true.

EMIL DIEHL.

Chemnitz, Germany.

Boring and Turning Flywheels and Pulleys.

Editor American Machinist:

Our 10x12-inch engine required a flywheel, or, more properly speaking, a flywheel pulley, 48 inches in diameter, 10-inch face, and a pulley 30 inches in diameter, 8-inch face. These were bored and turned in an old bull lathe, first being chucked against the face plate and bored and afterwards put on an arbor and turned. One 48x10-inch wheel required a day's work. This old lathe was consigned to the scrap pile and a modern pulley-turning and a pulley-boring mill were put in. These were companion tools, were set conveniently near each other, and could be served either by their own jib crane and air lift or by the electric crane. In operating these machines, it was not considered necessary to employ a machinist, a handy laborer being selected and taught to run them. It was made this man's duty to bore and turn all flywheels and pulleys 60 inches in diameter and below, also to balance and keyseat them, and likewise to bore all the steam cylinders 6½ inches in diameter and below. For such a man to do all this, it was necessary that every convenience possible should be supplied. To test the balance of the wheels, a table or broad track was set in, level and even with the floor. This track was 10 inches wide and 6 feet long and made as shown in Fig. 1. It was set on two sole plates, these plates resting on masonry; the set-screws shown being used to readjust the track when necessary. To a post close to the track a vertical drill was attached. The head and the drill spindle were movable up and down the post and could be located at any hight required to receive under it all pulleys and flywheels from the smallest to 60 inches in diameter, where they were drilled to receive the balancing weight.

Within the radius of the jib crane used in serving the pulley mills, a key-seating machine was placed. The capacity of the pulley-boring mill was sufficient to supply the wants of several turning mills; consequently, it could be utilized for boring small cylinders and other work if desired. A 48x10-inch flywheel was put on the boring mill and the rough cut made with an arbor holding four Mushet steel cutters, thus allowing a fast feed. The four cutters were set on the same plane and ground so that each one did its equal share of the work. In roughing out the hole, the spindle was at first fed down by hand, slowly, allowing the cutters time to true out the cored hole at the start before throwing in the quick feed. The hub of a 10-inch-face wheel was 8 inches long; the feed used was ⅛ inch per revolution, being 1-32 for each cutter. Running at a speed of twenty to twenty-five revolutions the hole was roughed out in about four minutes. The arbor holding these roughing cutters was fitted to the spindle with a quick taper, as shown by Fig. 2; the key used in holding the arbor in place also being used to force it out by driving it in the slot above the end.

The arbor carrying the finishing tool was a duplicate of the roughing arbor at its upper end. By this arrangement changing from one to the other was very easily and quickly done. The finishing cutter was fitted to the arbor as shown by Fig. 2, the slot being milled out with taper as shown, the cutter *B* having a hole larger than the bolt, and being also slotted vertically to allow the cutter to be moved upward and outward to allow regrinding and adjusting to size when necessary; the bolt clamping the cutter firmly. This form of cutter will do much better work than the double end, and the adjustment being so easily made, the work could be kept to size with much less trouble than with a

double end cutter. The roughing cutters brought the hole to within less than 1-16 inch of the finished size, leaving a very light cut for the finishing tool. With these tools the holes could be brought accurately to size, no reamer being used. As many as one hundred wheels were bored without re-adjusting the finishing cutter; 3-32 inch feed was used in finishing the hole, requiring about five minutes. Truing the wheel and clamping it to the face-plate required from five to eight minutes, the average time consumed per wheel being fifteen minutes.

The turning mill used was one of the latest design, having two tools, one on each side of the pulley—the one cutting with the cutting edge upward and the other with it downward. The cuts were started in the center of the face of the wheel, and the tools fed in opposite directions. The drivers furnished with this machine, Fig. 3, were practically worthless for turning wheels above 24 inches in diameter. The shank fitted into the compensating face-plate of the machine. This had a number of holes at various distances from the center, to reach wheels of various sizes. These drivers were too light, and they had no side supports to prevent the thrust of the tools from springing the wheel. The thrust of the tools, when making the roughing cuts, would spring the wheel so that the cut would be very uneven, and finally the pressure would become so great that the wheel would spring back to its proper position, thus leaving a part of the surface untouched, the tools then starting a new cut as sketched at Fig. 7.

To overcome this, three drivers, Fig. 5, were made. The wheels having six arms, the support given by these drivers permitted heavy feeds to be used, and at the same time left the wheel so nearly true that the finishing cuts were very light, and a feed of ¾ inch could be used. The rim was about ⅝ inch thick, and to finish the edges an ordinary side tool was used, it first being set as shown by Fig. 4, 1, and fed up by hand, cutting away the corner; second, as shown at 2; third, as shown at 3; the edge being finished in the shape shown by this figure. With this turning mill, using the drivers illustrated, the air-lift and the crane, six 48x10-inch wheels could be turned in ten hours.

While the rough cuts were being made, the operator would roll a wheel on the balancing track, locate the light side and ascertain the weight required by using clamps shaped like Fig. 6. These were made of various sizes of iron and of various lengths, so that any desired weight could be made. They were slipped over the edge of the rim and the wheel rolled and adjusted until it would stand in any position on the track. The clamps were then taken off and weighed, and the amount of weight and the position in which it was to be placed marked on the rim. The wheel was then rolled under the drill press and rivet holes drilled to secure the balance weight. This was riveted on at the convenience of the operator.

The key-seating machine was, properly speaking, a broaching machine, the cutter being drawn through the hole and cutting the seat at one passage. To do this, the wheel was placed on the arbor of the machine, standing vertically, no fastening being necessary. The machine was started, and in less than a minute the seat was cut, the entire operation requiring less than five minutes. Balancing complete and cutting the key-seat could readily be done in fifteen minutes. An active man could easily bore, turn, balance and key-seat six 48x10-inch wheels in ten hours, and have considerable time to do other boring work.

The operator was paid a fixed price, according to the size, for each wheel finished, and also a price for each piece of other boring work done each day. These prices were fixed before anyone was put to work on the job, and were *not changed*. In the beginning, the wages earned were small, but after two or three weeks the amount earned was larger than the man had ever earned before, and the amount of work turned out by these tools was highly satisfactory. B. W. T.

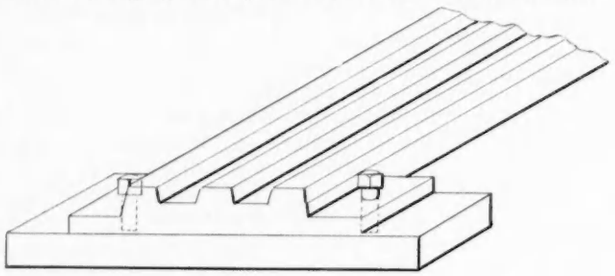


Fig. 1

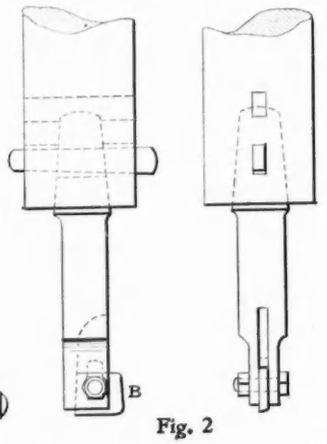


Fig. 2

Fig. 7

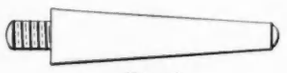


Fig 3

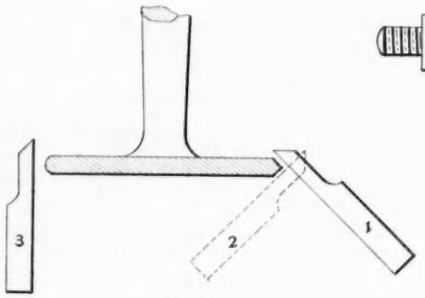


Fig. 4

Fig. 6

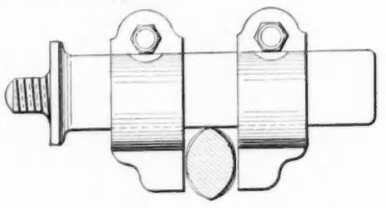


Fig. 5

TOOLS AND APPLIANCES FOR BORING, TURNING AND BALANCING PULLEYS.

Boring Elliptical Holes.

Editor American Machinist:

In your issue No. 26 you illustrate a machine for cutting elliptical holes which is stated to be the patent of John S. Worth, Coatesville, Pa. I have seen a number of machines built on similar lines working in this country, my recollections of this class of machines extending over the last twelve to fifteen years. It is perhaps worth while to point out that the machine as shown and described in your journal will not cut an ellipse, the figure produced being of an oval or egg-shaped form, and therefore useless in cases where a true or even approximate ellipse is required. The variation from the true form is, of course, caused by the angularity of the connecting rod, and the error is very considerable with connecting rods of any practicable length.

An improvement in the design and one which will produce (humanly speaking)

a theoretical ellipse is a machine made by Messrs. G. & A. Harvey, of Govan, near Glasgow. I do not know the date of the machine, but a cut of it has been in my possession eight or nine years. In the machine to which I refer a cross slot and sliding block are substituted for the connecting rod, which eliminates the error due to angularity in a manner that will be quite obvious to your readers. Machines on the above principle are quite common in this country and are made by many of the leading tool makers, being used for such purposes as the mud holes in Lancashire and Cornish boiler end-plates, hand holes in water-tube boilers, etc., etc. The ellipse may be formed by setting the tool to either the major or minor radius of the ellipse, the action of the crank pin being in one case to draw the circle out, as it were, into an ellipse and in the other to compress it into the form required.

P. V. VERNON.

Coventry, England.

[And yet the United States Patent Office allowed a patent for the device. We should have known better than Uncle Sam, and if we had considered it as long as a patent examiner doubtless did, we cannot think we would have been caught.—Ed.]

A plumber's gasoline blower exploded "for cause," and with fatal results, in a Brooklyn residence a few days ago. Two plumbers were repairing the hot-water tank attached to the kitchen range, doing it without hauling the fire and letting the range cool, even placing the blower close to the hot range. There was an explosion, and the lady of the house and one of the plumbers have since died from the burns and other injuries, and it is not yet determined whether the other man can survive.

Manufacturers.

Pitman & Brown, Salem, Mass., are to build a wood-working mill.

The York Chemical Company, York, Pa., will erect a new sulphuric acid plant.

The Chicago Stopper Company is about to build a large glass works at Porter, Ind.

Gideon Studley, box manufacturer and lumber, is rebuilding his mill at Rockland, Mass.

A lumber mill will be erected by the Clifford & Fox Lumber Company, at Stevens Point, Wis.

Brown Bros. are erecting a basket and crate factory, a cannery, a sawmill and a grist mill at Bridgeville, Del.

An addition to the engine-house of the tissue paper mills at Carthage, N. Y., is in process of construction.

The Hoopes & Townsend Company, Philadelphia, Pa., is to build a large rolling mill near Fort Washington, Pa.

Thomas M. Seeds, Jr., Philadelphia, Pa., will erect a six-story factory building at 1023-1027 Race street, to cost $30,000.

The shingle mill of H. Lundgreen, of Tacoma, Wash., has been burned, and he proposes to build a new one in Olympia.

A permit has been issued for a foundry for the F. M. Davis Iron Works Company, Larimer and Eighth streets, Denver, Colo.

An addition will be built to the plant of the Oswego Machine Works, manufacturer of paper-cutting machines, Oswego, N. Y.

H. B. Reynolds & Co., stoves, etc., Allenton, R. I., are putting up a manufacturing building at Belleville, a suburb of that place.

Clarence Simpson and others will start a foundry in the old Stanton Heater Company building in the First ward, Bellaire, O.

Wm. Hill has in hand the raising of the capital stock for a cotton factory at Alexandria, La., and $80,000 has been subscribed.

A permit has been issued for a $7,000 building for the Pioneer Brass Works, at 418-420 South Pennsylvania street, Chicago, Ill.

Morrissey & Shea, Springfield, Mass., contractors and builders, have the contract for a new boiler-house for the Indian Orchard Company.

George P. Bent, piano manufacturer, will build a six-story addition to his plant on Washington boulevard and Sangamon street, Chicago, Ill.

The Cornplanter Oil Company, manufacturer of lubricating oils, Minneapolis, Minn., contemplates putting up a large plant at West Superior, Wis.

George W. Reiff, Spring City, Pa., is to establish an underwear factory at Media, Pa., the buildings to cost $15,000, and the machinery as much more.

A company has been formed at Clarksburg, W. Va., to back D. V. Sprinkle in the manufacture of a pulley with a veneered rim. It is to have $40,000 capital.

C. Larson & Co., who recently purchased 150x125 feet at the northeast corner of West Kinzie and Leavitt streets, Chicago, Ill., will build a factory, to cost $60,000.

Alterations and improvements will be made to the building at 717 Vine street, Philadelphia, Pa., for the Hensel-Colladay Company, manufacturer of dress trimmings.

Two 50x150-foot buildings will be erected on High street, Columbus, O., by the Segrave Manufacturing Company, makers of high-grade fire-extinguishing apparatus.

A mill is to be erected near Joplin, Mo., to work the product of zinc mining property owned by Charles Walton, J. W. Clark, F. J. Greer and other men of Fort Wayne, Ind.

The Engelberg Huller Company, manufacturer of rice and coffee milling machines, Syracuse, N. Y., is erecting a foundry, 32x132 feet. It will be ready for occupancy in about two months.

John G. Speidel, Reading, Pa., will erect a 95x97-foot building on Gordon street, between Buttonwood and the Lehigh Valley Railroad for the manufacture of elevators and hoisting machinery.

The Dixie Carpet Washing Machine Company, Evansville, Ind., expects eventually to enlarge a plant which it has at Chattanooga, Tenn., and manufacture carpet washing machinery on a large scale.

The Chattanooga Steel Roofing Company, Chattanooga, Tenn., will have a new foundry, 100x150 feet in size. Its power plant will be electrical and the cranes and lifts will be operated by compressed air.

Robert Hightower, general agent for the Macon & Birmingham Railroad, with headquarters at Thomaston, Ga., is endeavoring to secure a cotton mill for some point along the road, preferably Thomaston.

C. V. Grimes, of the Grimes Shuttle Block Company, Durham, N. C., has leased a tract of land at Chattanooga, Tenn., on which he proposes to erect a factory which will cost, with the machinery, about $20,000.

An eight-story factory building, 40x100 feet, is to be erected at the southwest corner of Ontario street and La Salle avenue, Chicago, Ill., after plans by Architect John H. Wagner. It will cost about $50,000.

The Liberty (S. C.) Cotton Mills, with capital stock of $100,000, have organized, with J. P. Smith, president and treasurer, and commenced work on their plant, in which will be installed 6,000 spindles and 200 looms.

The Monarch Mill Company's shingle mill at Blaine, Wash., and the plant of the Blaine Electric Light & Power Company, controlled by the former company, both of which plants were burned last February, will be rebuilt.

The City Council, Muscatine, Ia., has granted concessions for the establishment of a $100,000 factory. It is thought to be a pearl button finishing plant. The representative of the new enterprise is N. Barry, Jr.

Plans are being prepared for a new factory for the Bridgeport Leather Belt Company to be built on Iranistan avenue, corner of Washburn street, Bridgeport, Conn. It will be 40x100 feet, two stories high, of brick.

Citizens of Social Circle, Ga., have organized a stock company to build a $10,000 cotton mill. They have elected J. B. Robinson president; J. M. Hurst, Jr., vice-president, and Lipscomb Newton, secretary and treasurer.

The management of the Garrett gas engine works, Garrett, Ind., has accepted an offer from A. C. Robbins looking to the occupation of the old Auburn (Ind.) foundry and machine-works building, and will remove to the latter town.

A silk mill is proposed at Jerseyville, Ill. Among the directors of the new company which has it in view are named A. W. Cross, president of the National Bank of Jerseyville, and S. H. Bowman, president of the State Bank of Jerseyville.

There is talk of a new steel plant at McKeesport, Pa., on a 15-acre river-front tract owned by E. P. Douglas, E. F. Wood and J. C. Smith. The owners have an offer by another company to buy three acres of the ground for a machine shop.

The plant of the City Iron Foundry at Woonsocket, R. I., is to be removed to Pawtucket, at the corner of York and Prairie avenue. The equipments of the Vulcan foundry, recently sold, were bought by the City Foundry, and the plant will be made a good one.

Work has been begun on the extension to the Benjamin Atha & Illingworth Company's steel works, near Newark, N. J. The new building will be 198x85 feet, and will be equipped with three cranes and other machinery. Five coke ovens will be connected by a system of tracks.

The Committee on Works, Toronto, Ont., has approved a report of the city engineer recommending two new pumping engines, and the Council will be asked to submit a by-law to the people to raise $153,480, which would allow for a 15,000,000 and a 5,000,000 gallon engine and new water mains.

Broomell, Schmidt & Co., Ltd., manufacturers of steam-heating supplies, York, Pa., owing to growing business, are broadening their policy. They have become the Broomell, Schmidt & Stacey Company, with $100,000 new capital at command, which will enlarge the plant, and install additional machinery. This enlargement is made necessary by contracts already booked.

The American Bridge Company has commenced making large shipments of the steel work for the subway in New York city. Already several thousand tons have been shipped, and the material is now being sent in at the rate of about 100 tons per day. The total contract comprises about 80,000 tons of structural material, and is being manufactured at the Keystone plant of the American Bridge Company.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant ; see p. 20.

Dies & punches. Amer. Hdw. Co., Ottawa, Ill.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Gas engine castings. Box 181, Springfield, Mass.

For Sale—20 H.-P. boiler and engine combined. Box 1171, Springfield, Mass.

Light and fine mach'y to order ; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, Pa., build light machinery.

Selden Packing for Stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

Threads and gears ; easy rules to cut any thread possible to be cut in the lathe, without algebra, sent to any address for 25c. (postal order) by G. W. Dixon, Spring Lake, Mich.

Machine shop for sale in the eastern part of Wisconsin, doing a general repair and jobbing business, also selling engines, boilers, machinery, etc. Box 306, AMER. MACHINIST.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Mechanical draftsman wishes to change. Address Box 5, AMERICAN MACHINIST.

Draftsman (machinist), 23 years, wants position. Address C. A., 1219 3d ave., Brooklyn.

Experienced draftsman wants a situation ; machine tool or labor-saving machinery preferred. Box 351, AMERICAN MACHINIST.

Situation wanted by toolmaker ; has had charge ; age 27 ; steady and sober. Address "Out," care AMERICAN MACHINIST.

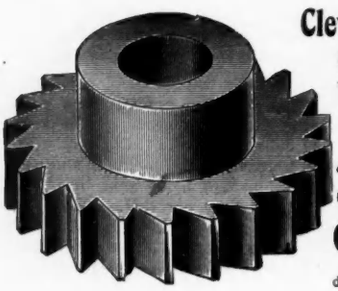
Expert in designing and testing pumping machinery and air compressor desires situation in New York. Box 4, AMER. MACHINIST.

Graduate mechanical engineer desires position as assistant engineer or draftsman ; 3 years' practical experience ; reliable. Address Box 349, AMERICAN MACHINIST.

Position as chief draftsman on machinery wanted by young mechanical engineer, with 4 years' experience as draftsman. Address "Ability," care AMERICAN MACHINIST.

A first-class general foreman wishes to make a change ; can handle 200 men. If you

(*Continued on page* 43.)



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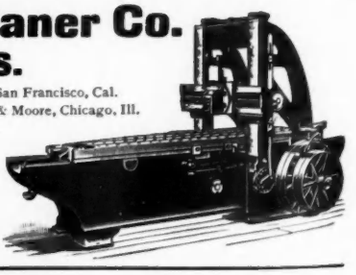

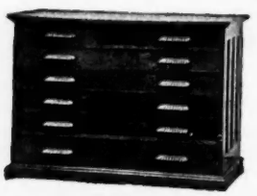

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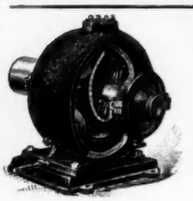

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